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ABSTRACT

This dissertation examines the impact two technology-based delivery systems--telecourses and Web-based instruction--have on the student's learning experience, compared with an equivalent classroom-based instructional method. The sample was comprised of 78 students from Lakeland Community College in Ohio. All of these students were enrolled in Math 155, which was offered in each of the three instructional methods. Outcome measures assessed included students' final course grades and attitudes as measured by survey response. In addition, the research took into consideration age and gender to see whether these characteristics affect students' achievement regardless of delivery method. The results showed that there was no significant difference in the final course grades in the classes using the two forms of distance learning as compared with students' performance in the traditional lecture-based class. This research has implications for two-year institutions as they explore alternative means of access to instruction to meet the needs of a diverse student population. Appended are: Pre-Script for Comparison of Student Performance and Attitude in a Lecture Class to Student Performance and Attitude in a Telecourse and a Web-Based Class; Statistics Pre-Test; Post-Script for Comparison; Student Attitudinal Survey; and Overall Attitudinal Survey Results. (Contains 32 tables and 138 references.) (Author/JCC)

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2001

An Abstract of a Dissertation submitted to Nova Southeastern University in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy

Comparison of Student Performance and Attitude in a Lecture Class to Student Performance and Attitude in a Telecourse and a Web-based Class

by
William J. Ryan

June 2001

Increasing numbers of students are returning to school and choosing alternatives to the lecture method of instruction. Using technology to reach students is a solution colleges and universities are evaluating and implementing with the goal of increasing enrollment and reducing the cost of instruction. This research examines the impact two technology-based delivery systems have on the student's learning experience compared with an equivalent classroom-based instructional method.

Academic institutions are being asked to respond to the rapid changes faced by the communities they serve especially as current workers return to join new students in obtaining knowledge and skills needed in today's workplace. The key technology of today's economy is based on access to instruction; however, the data is limited in describing the characteristics of distant learners and the effectiveness of telecourses and web-based instructional systems compared to the lecture-based system. This research is a qualitative and quantitative study that examined and evaluated traditional lecture-based, telecourse, and web-based instructional delivery systems during an academic year. The hypothesis of this research is that there is no significant difference between the three instructional delivery systems in terms of performance, measured by a pre-test and overall final course grade, and attitude measured by survey response.

The research project is based on a quasi-experimental design with three key factors. The first factor is the instructional delivery system (lecture class, telecourse, and web-based), the second factor is gender, and the third factor is age. For this study the students were defined as either traditional age (under the age of 22) or non-traditional age (22 years and older).

This research provides data to the educational community that indicates student performance is not impacted by their choice of a telecourse or a web-based section. There was no significant difference in the final course grades in these two forms of distance learning delivery systems when compared to final course grades earned by students in the traditional lecture class during the academic year.

The results will provide academic and administrative teams with additional data to assist in the implementation of appropriate instructional delivery systems. This research can provide institutions with facts that will allow them to utilize technology-based delivery systems confident that students will not be negatively impacted when compared to conventional teaching/learning methods.

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Chapter 1

Introduction

Problem Statement

Using technology to reach students unable to attend classes is a solution colleges and universities are evaluating and implementing. Increasing enrollment and reducing the cost of instruction is a goal many educators believe technology-based systems will deliver. These systems will allow institutions to be competitive in the future yet these technology-based systems are "challenging the primary assumption of the current instructional model: that the only way to achieve effective student learning is for faculty members to meet with groups of students at regularly scheduled times and places." (Twigg, 2000a, p. 42).

This research focused on examining Foshee's (1999) premise that technology's "real value is in the provision of useful and seemingly transparent tools that can be used effectively to enhance access and improve the teaching and learning process." (p. 29). In a review of 100 studies of student learning at the college level conducted in 1972 by D. A. Bligh, the conclusion was that students who "interact with other students and are engaged in the discussion of their ideas are less likely to have irrelevant or distracting thoughts and spend more time in synthesizing and integrating ideas and

concepts compared with students who listen to lectures" (as cited in Pinheiro, 1998, p. 119). This research examined the possible impact technology-based delivery systems have on a student's learning experience compared to a classroom-based instructional learning experience.

Interaction has been identified as important to the learning process (Tam, 2000) and technology-based systems can be used effectively to engage the learner (Ellis, 2000; Tam, 2000). This was important to this study as it referenced the traditional and social experience a classroom provides. Technology can be interactive and can provide an individual with an "experience with communication in novel social contexts" (Duran, 1992, p. 255). The benefit of this study is the examination and evaluation of the data collected identifying overall gains and results on student satisfaction, grades, and the physical, mental, environmental, and technical obstacles encountered by the student. Collecting this data was vital to ensure that a level of quality was maintained by all instructional delivery systems and supported Marshall Smith's, the US Acting Deputy Secretary of Education, statement that the growth of distance learning courses will "heighten the importance of gathering performance data." (as cited in Carnevale, 2000a, p. 2).

The results collected will be able to be used by other institutions that are considering the financial investments in appropriate technology. The interactive learning process encourages the implementation of collaboration tools that technology can provide, "technology is essential in order for institutions to provide quality education at a

distance for the increasing numbers of nontraditional students." (Pinheiro, 1998, p. 129). It is the growth of learning opportunities available to all students of all ages that spurs the use of varied technology tools used for cooperative learning in order to "prepare them for the technology-driven, team-oriented workplace of tomorrow." (Chrisman, 1998, p. 82).

Project Goals

This research was a qualitative and quantitative study that examined and evaluated traditional lecture-based, telecourse, and web-based instructional delivery systems. The hypothesis of this research was that there was no significant difference between the classroom-based lecture course, video-based telecourse or the online, web-based course in terms of performance as measured by overall final course grade and attitude as measured by survey response. Professor Ronald E. Turner teaches economics at Eastern Maine Technical College and identified that grades alone do not tell the full story about the quality of instruction a student receives. Consideration should also be given to the feedback obtained from the student and then analyzed statistically in order to provide insight into areas that can be modified and improved upon (Cortada, 1998, p. 251).

It was anticipated that results from this study would benefit the academic community that faces the challenge of investing in distance learning technologies while striving to provide students with quality course offerings. The data that was obtained and evaluated may be used by other institutions as a measurement for evaluating the effectiveness of

their course offerings. Information from the National Center for Education Statistics identified three primary types of technology that are currently being used as instructional delivery systems. These include asynchronous web-based courses and one-way pre-recorded video programs, known as telecourses, being ranked one and three with two-way interactive video classes being ranked second (Boettcher, 2000, p. 40). This research examined how these delivery systems may impact a community college's rationale and choice for future growth and expansion of instructional programs and technology-based delivery systems especially as they compare to the benchmark of a traditional lecture class.

The results gathered provide academic and administrative teams with additional data to assist them in their implementation of an appropriate instructional delivery system to meet their needs. It also provides data to assist institutions in planning for future expenditures and optimal use of technology. Since no significant difference was discovered between the delivery methods, this research allows "us to employ cheaper and simpler technologies with assurance that outcomes will be comparable with the more sophisticated and expensive ones as well as conventional teaching/learning methods." (Russell, 1999, p. xiii). This study analyzed three delivery systems: lecture-based, telecourse, and web-based, that are currently used in delivering instruction. Since little work has been done to date to determine if there is a sound rationale for implementing emerging technologies, such as web-based instruction, or expanding existing modes of delivery, such as telecourses, or offering more lecture

classes, the data from this study provides institutions with information to assist them in determining the most cost and time effective solution.

The data was analyzed and may provide other institutions additional rationale to support or reduce the investments in technology that provide delivery of instruction using computer, television and/or classroom systems. The technology-based systems, especially computer systems, can convert "existing material without loss of quality (since everything is digital) and will reduce production time and associated costs, thereby increasing the life of the product." (Ryan, 1993, p. 7). This research yielded data that indicates possible areas of reduced production time, and support staff time due to a "growing ease and simplicity in developing and maintaining the learning packages, databases, and intranet sites with a minimum of cost and time." (Marquardt & Kearsley, 1999, p. 61). This research yielded additional data from the perspective of the student learning experience. Student attitudes are a vital criterion to assist institutional leadership in determining the effectiveness of a distance education program, "a criterion that is arguably as important as the most-often cited outcome measurement in the current literature, student achievement." (Biner & Dean, 1995, p. 10). Student attitude and achievement are vital but institutions also want to know who the student is and how the institution can attract students to their program offerings. This study also analyzed if gender and age are impacting the effectiveness of instructional delivery systems. Studies have indicated telecourse and web-based students are primarily females over age twenty-five (Easterday, 1997; eCollege,

1999) with the traditional college student between the ages of eighteen and twenty-two (University of Illinois, 1999).

Relevance and Significance

Higher education is observing the rapid growth of distance learning not only as a "supplement to traditional institutions and programs, but also as a replacement for those institutions and programs. Further, distance learning is seen by many as a transformative vehicle for increasing the pace of change and reform in higher education." (Phipps, Wellman & Merisotis, 1998, p. 1). The review of literature identified that distance learning in a community college setting, especially telecourses, "accommodates nontraditional learners and students living in rural settings, primarily employing low-end technology in its outreach service." (Swienciki, 1996, p. 179). In a study conducted at Calhoun Community College, it was found that there was no significant difference in grade distribution between telecourse students and traditional classroom students (Searcy, Howton & Yarbrough, 1993) which supported similar research comparing telecourse and classroom students conducted by Chu and Schramm (1979) and Wilkinson (1980). Another study came to the conclusion that "on-line students' performance was quite comparable to, and in some cases excelled, that of their classroom counterpart." (Ridley & Sammour, 1996, p. 338). A study conducted at Christopher Newport University found that web-based course offerings impacted the institution's full time enrollment (FTE) confirming "that net FTE gain can accrue even when students overwhelmingly commute from inside the traditional service area." (Ridley, Bailey, Davies, Hash & Varner, 1997, p. 16). This research study examined the

individual delivery systems noted above with the lecture mode to discover if the use of a technology-based delivery system impacts the student and the institution.

Telecourse programming, often delivered via public television stations or cable television systems, has coexisted with traditional lecture-based offerings since the early 1980s in many institutions. "Higher education has begun to recognize the profound implications of the merger of telecommunications technology with computer technology." (Langenberg, 1999, p. 16) and the desire to increase student enrollment is moving academic institutions into the evolving world of web-based education (Arenson, 1998). This desire is driving the implementation of "new technologies which allow teachers to reach students in their homes and at their distance and often rural learning sites." (Hammond, 1997, p. 3). Institutions are exploring and evaluating various methods to "use technology to connect students more effectively with faculty, counselors, other students, and appropriate services and information resources." (Acebo, Burrus & Kanter, 1998, p. 14).

Institutions are looking to the future and to their own growth and survival as well. "Ten years from now, more than 25 million people will be registered for post-secondary learning experiences in the United States alone" (Twigg, 1999, p. 13). Many of these future students will look to learning options in their community because "they will be seeking updated skills and knowledge to obtain better jobs or to perform more effectively in their current positions." (Twigg, 1999, 13-14). A report prepared for the Council for Higher Education Accreditation supports the efforts of

distance learning providers to make instruction learner-centered which is defined by three basic qualities, that "instruction is largely self-directed; it is more focused and purposeful; and it employs the appropriate level of faculty mediation." (Phipps, Wellman & Merisotis, 1998, p. 1). Learner-centered systems speak of using technology effectively (O'Banion, 1997) in order to create an environment where students can "gain access to information, to interpret it, to give it context, to use information to solve problems, and to collaborate with others in problem solution." (Doucette, 1994, p. 23).

Technology is challenging institutions to be effective in new and different ways as well. New facilities are being defined in terms of cable backbone and infrastructure support systems instead of bricks and mortar (Flynn, 2000) although "at their core all the institutions look pretty much alike (i.e., a credit-for-contact system of classroom-bound lecture, discussion, and print-oriented instruction)" (Munitz, 2000, p. 15). A question being raised in response to this challenge is whether to continue the investment in cable television technologies used in delivering telecourses or invest in web-based delivery systems. Telecourses offered via cable are very cost-effective since these "programs can be viewed by an unlimited number of people within a broadcast area without affecting the delivery cost." (Marquardt & Kearsley, 1999, p. 88). This technology is very stable and many "educators view the telecourse-delivery system as a way of reaching new groups of potential students. Others see the telecourse delivery system as a college-entry option for students who are intimidated by traditional classroom instructional experiences." (Willett, 1986, p. 33). Another

viewpoint identified by Brown (1988) is that "All things being equal, face-to-face interaction is the preferred learning mode for most people. Television viewing represents passive learning and participants' cognitive engagement appears to wane over extended periods of viewing time" (p. 9).

A challenge instructional teams face is how to deliver content effectively using the new, web-based technology. A course delivered via the Internet has shown to be cost effective (Phillips, 1998; Thatch & Murphy, 1995) and provides options that make it an attractive teaching tool as well. "Well-designed and properly implemented, computer-assisted, independent learning systems are effective in increasing student learning at acceptable costs" (Doucette, 1994, p. 22). The rapid growth of computer systems capable of communicating at reasonably fast speeds allow audio, text, graphics, and even limited video to be seen in locations ranging from the office to home inexpensively (Dyer, 1996). However, costs must be factored into alternate delivery systems since instruction delivered traditionally, such as a lecture in a classroom, initially has a lower cost than instruction designed and delivered using technology (Ryan, 1997).

Online instructors at Christopher Newport University "rated student performance and learning in the areas related to general skills development significantly higher in online than in classroom courses." (Ridley & Sammour, 1996, p. 338). Providing instruction in a manner that will allow students to perform better is a goal of an institution of higher learning and its faculty. With this goal of student performance in

mind it has been observed that community college students are becoming more accustomed to tools and services that provide access to information and they expect these systems to be a part of their educational experiences (Milliron & Miles, 1998, p. 23). Technology, especially the Internet, has expanded the service area where institutions can offer programs and is challenging many institutions' missions.

Barriers and Issues

Creating the framework for this study presented several significant problems. Among the issues, the following were identified:

1. This study, with the approval of the hosting institution, offered the course of instruction via all three delivery systems during the Fall 1999 academic quarter. This study was limited to students enrolled in Math 155: Statistics, at Lakeland Community College. The option of offering this course of instruction during subsequent quarters was welcomed by the hosting institution and was deemed necessary to allow adequate data collection.

2. Another barrier was the number of students that completed video-based, as well as the web-based, version of this course of instruction. Various studies (Ellis, 1998; Hammond, 1997) have documented this danger in both delivery systems. This problem "may be due to immature students who are unable to handle the greater autonomy of distance learners" (Easterday, 1997, p. 30).

3. There was a difficulty in the low number of studies comparing these three delivery systems found to date in this area. Reference works were found that compared two different delivery systems and these studies supported the hypothesis that there was no significant difference in performance as defined by overall final course grade between the varied delivery systems. For example, studies compared traditional lecture and interactive video systems (Boen, 1983; Dalton, 1986; Kearlsey & Frost, 1985; Litchfield & Mattson, 1989), traditional lecture and telecourse offerings (Brey & Grigsby, 1984; Smith, 1984; Crane, 1985; Klinger & Connet, 1992; McNabb, 1994), and a 1998 study conducted at North Carolina State University that compared a web-based class to a lecture class and found no significant difference in the final course grade between sections and found no significant difference between gender as measured by the final course grades in the undergraduate sections used in the study (Hoey, Pettitt, Brawner & Mull, 1998). One study cited by Schulman and Sims (1999) compared a web-based to lecture class and found that "wired students outscored their traditional counterparts by an average of 20 percent." (p. 55) on the midterm and the final exam. While many studies indicated no significant difference, this research supported the idea that using alternative delivery systems can increase efficiencies in time for the student and bridge distances between school and the student thereby removing barriers to learning.

Constraints and Limitations

While this study offers a unique comparison between student performance and attitude in a lecture class to those offered via a telecourse and a web-based class, it had a limitation in the number of students in the population. The community college where this study took place did not traditionally enroll large numbers of students in its classes. It is a constraint this study faced and one reason the length of the data collection proposed be extended for the entire academic year.

Another constraint this study faced was that the lecture class used a comprehensive final exam that, combined with test scores taken during the term, provided the overall final course grade. The telecourse and the web-based course used a non-comprehensive final exam that was combined with a mid-term exam to determine the overall final course grade. A concern focused on the calculation of the overall final course grade being impacted by the difference in the collection of the different tests. This concern was included in the analysis process conducted in this research. All three sections, delivered via the three delivery systems, were approved by the college's curriculum committee and met the objectives and goals defined in the course catalog for this course of instruction.

Other constraints included the use of additional faculty members who taught other sections of the course under study, students who chose not to participate, and possible higher than average withdrawal rates.

Research Questions

The focus of this research was to obtain increased knowledge of the issues encountered by students as they learned a topic via an instructional delivery system. While institutions are using technology systems to deliver instruction and enhance learning, some "faculty felt that technology might in fact inhibit learning" (Milliron & Miles, 1998, p. 35).

The research questions addressed by this study were:

1. Would there be a significant difference in student achievement, as measured by overall final course grade, related to the instructional delivery method?
2. Was student achievement, as measured by the overall final course grade, impacted by the age and gender of the traditional student compared to the non-traditional student regardless of delivery method?
3. Did student satisfaction, as measured by attitudes towards the chosen delivery method, impact the overall final course grade?
4. Would students feel that time and travel options provided by telecourse or web-based delivery systems impact and/or enhance their overall final course grades compared to the lecture delivery method?
5. Would students feel those physical, mental, environmental, and technical obstacles within their chosen learning environment impact and/or enhance their learning experience in terms of performance?

This research compared how different delivery systems impact the learning experience as measured by the student's attitude as well as the impact as determined by their overall final course grade. A group comparison design (Cone & Foster, 1993) was used to evaluate independent variables such as visual, auditory, and technical issues. A factorial design with an analysis of covariance (ANCOVA) was used to evaluate grades and variables. An analysis of covariance was "used to equate groups on one or more variables" (Gay, 1992, p. 290) and the factorial design was used because "most real world outcomes are the result of a number of factors acting in combination" (Best & Kahn, 1986, p. 137). Additional data was collected on gender, age, experience with video and computer systems, and academic background. A rationale for the additional data items was to determine if a highly satisfied student population would result in "lower student attrition (drop-out rates), higher levels of student commitment to a program's current and future success, and a greater number of course/program referrals from the students to others." (Biner & Dean, 1995, p. 10).

Definition of Terms

Many terms were used in the course of this study and it would be appropriate to clarify them at this point. For the purposes of this study, the following definitions were used:

Distance Education

The revisions that resulted in the Higher Education Amendments of 1998 proposed in section 488, Distance Education Demonstration Programs, that the term distance

education "means an educational process that is characterized by the separation, in time or place, between instructor and student." (p. 4). The definition continues to describe content being offered primarily through the use of "(1) television, audio, or computer transmission, such as open broadcast, closed circuit, cable, microwave, or satellite transmission; (2) audio or computer conferencing; (3) video cassettes or discs; or (4) correspondence." (Higher Education Amendments, 1998, p. 4).

Internet

An open, global interconnection of computer networks permitting "a range of activities to be accomplished - among them exchange of electronic mail (e-mail), exchange of files, and remote login to computers - and provides access to a growing array of online information. Used today by many different communities in support of collaboration, cooperation, and dissemination of information, the Internet is viewed by its creators as a public resource." (National Research Council, 1994, p. 243).

Lecture

Traditionally classroom-based, the lecture is also known as a form of expository teaching, "teaching in which the instructional material is given to the student more or less in the form in which it is to be learned." (Ormrod, 1990, p. 283). The lecture system is instructor led and the location and time is determined by the institution. Students who choose lecture or classroom-based delivery generally go to campus several times a week for direct instruction by faculty.

Non-traditional Student

A non-traditional student can be described in a variety of ways including, for this project, "a distance learner, returning student, or as a participant in distributed learning. Typically non-traditional students at the college level are older, more self-motivated individuals, as compared to traditional students." (League for Innovation in the Community College, 1999, p. 91). For the purposes of this study a non-traditional student is 22 years of age and older.

Telecourse

Telecourses are delivered primarily via linear video programs delivered on public broadcasting stations, dedicated cable channels, and/or made available to a student in a pre-packaged set of videotapes. "Telecourse students study more independently, watching the television programs and reading the print materials at home and/or at work, with guidance from the course instructor through a variety of communications and instructional techniques." (PBS/Adult Learning Service, 1999, p. 1).

Traditional Student

"At the college-level, a traditional undergraduate student is typically involved in on-campus courses meeting in a classroom at regularly scheduled times." (League for Innovation in the Community College, 1999, p. 92). For the purposes of this study, a traditional student is under the age of 22 years.

Web-based Course

The primary method of delivering content is through the use of a computer and the World Wide Web. This delivery system allows students to obtain course content

independent of time or location. This delivery system allows a wide range of synchronous and asynchronous opportunities for interaction and communication with others via computer. This occurs through the use of email and discussion listservs and can be used for "class discussions, group project coordination, role playing, student critiques of each other's work, instructor feedback, on-line debates, homework submission, or collaborative writing." (Conway, 1998, p. 213).

Web Browser

A software program that allows users to move relatively easily from one information location on a web system to another, the browser displays graphics as well as text. It replaces textual commands with point-and-click graphical-based movement along the linked options available on the web.

World Wide Web (WWW or web)

A section of the Internet where vast pools of information are interlinked using hypertext, a software convention that allows you to jump from place to place, topic to topic, without being forced into a linear set of steps. The web allows text to be read in multiple fonts and colors but is associated with the extensive use of graphics, and other media-based options available to the user.

Summary

The first chapter introduced the proposed research, established its overall purpose and procedures and defined the terms that were used in the study. The project addressed

the question of how students' performance and attitudes are affected in a telecourse, web-based, and lecture class delivery system. To that end, this research directed itself to answer the following research questions:

- Would there be a significant difference in student achievement, as measured by overall final course grade, related to the instructional delivery method?
- Was student achievement, as measured by overall final course grade, impacted by the age and gender of the traditional student compared to the age and gender of the non-traditional student regardless of delivery method?
- Did student satisfaction, as measured by attitudes towards the chosen delivery method, impact the overall final course grade?
- Would students feel that time and travel options provided by telecourse or web-based delivery systems impact and/or enhance their overall final course grades compared to the lecture delivery method?
- Would students feel those physical, mental, environmental, and technical obstacles within their chosen learning environment impact and/or enhance their learning experience in terms of performance?

Chapter 2 offers a review of related literature. It begins with a review of current research and looks at studies and articles that identify the need for continued research as distance education implements and expands technology-based systems while distance educators seek quality for their students. Curriculum development, facility design, and student services are involved in how an institution can deliver instruction and increase enrollment efficiently and effectively. The first section of this review

explores the history and growth of education delivered over a distance and the guidelines which technology-based delivery systems, specifically telecourses and web-based, follow to create a learning experience for a student. The second and third sections of this review examine the characteristics, expectations, and applications of these technology-based delivery systems. The final section of this review examines how technology-based delivery systems compare to traditional classroom delivery and the costs and performance issues associated with development and implementation of technology-based education.

Chapter 3 presents a detailed design of the study. Included in this chapter is the description of the design methodology used to test the research hypothesis and the process of how this research was conducted. The various criteria used in collecting data and the techniques used in analyzing the data are also described here. Finally, the assumptions and limitations contained within this research project are detailed and noted.

Chapter 4 summarizes the results of the study. The data analysis developed is presented and the correlation and relationships between groups is listed and noted in this chapter. The hypotheses are broken down and examined in detail in this section.

Chapter 5 concludes this report with a summation of the analysis of the results presented in Chapter 4. Summaries and conclusions of the results and possible implications for future research are also described in this chapter.

Chapter 2

Review of the Literature

Introduction

The scope of this research impacts many different areas of institutional planning regarding the delivery of instruction. Curriculum development, facility design, and student services are involved in how an institution can deliver instruction and increase enrollment efficiently and effectively. The goal of this research was to compare and evaluate three different instructional delivery systems including traditional lecture-based, telecourse, and web-based. The first section of this review explores the history and growth of education delivered over a distance and the guidelines which technology-based delivery systems follow to create a learning experience for a student.

Technology-based delivery systems and their impact on how students learn was the scope of this project. One system, telecourses, has been widely adopted by community colleges because historically community colleges do not have a residential student population and, therefore, use this technology to deliver instruction remotely. The rapid growth and ease of use of the Internet and specifically the World Wide Web has quickly become a viable and active method of delivering instruction to

students independent of time and location. Therefore, the second and third sections of this review examine the characteristics, expectations, and applications of these technology-based delivery systems.

Finally, this study was concerned with effectiveness in terms of student achievement and cost to the institution. The final section of this review examines how technology-based delivery systems compared to traditional classroom delivery and the costs and performance issues associated with development and implementation of technology-based education.

Distance Education

The revisions that resulted in the Higher Education Amendments of 1998 proposed in section 488, Distance Education Demonstration Programs, to define the term distance education as an "educational process that is characterized by the separation, in time or place, between instructor and student." (p. 4). This research took place at a community college and studies have shown that two-year colleges "have been active and taken a leadership position in the development and delivery of courses for distance education." (Easterday, 1997, p. 33). Distance education programs have used a wide variety of media to reach and serve the remote or distant student from the development of correspondence courses in the late 19th century (Thomerson & Smith, 1996) to video-based programs such as telecourses (Willett, 1986) and now include web-based instruction (Ridley & Sammour, 1996). "Distance education programs have been

shown to be effective in meeting the educational needs of rural and non-traditional students, who often are geographically separated from a college or university" (Thomerson & Smith, 1996, p. 47).

Higher education is observing the rapid growth of distance education not only as a "supplement to traditional institutions and programs, but also as a replacement for those institutions and programs. Distance learning is seen by many as a transformative vehicle for increasing the pace of change and reform in higher education." (Phipps, Wellman & Merisotis, 1998, p. 1). The rapid growth of digital technologies, continued expansion of cable television, "the emergence of new institutional players, the altered expectations of the employee workforce, and the changes in the student market will all be catalysts in the transformation." (Munitz, 2000, p. 14). The cost of this transformation is focused on the expense and time investment of adding new production and delivery systems to the instructional process. A part of this process involves the increased use and reliance on technology-based tools in the workplace and the impact this has on the institution's organizational structure, its business functions, and the new requests from the student community that expects efficient customer-based service. One example of the heightened importance individuals place on obtaining additional education is the rise in corporate universities and for-profit universities, such as the University of Phoenix, that work to meet all students' needs of education while working around work and life commitments. "Particularly in the area of skill development, for-profit enterprises have moved quickly and decisively to educate adults" (Katz & Oblinger, 1999, p. 303).

Institutions of higher education, especially community colleges, are offering distance education programs to meet growing expectations and requests from the communities in which they operate. Research from the International Data Corporation (IDC) (1999) supports this expectation stating that by "2002, 85% of two-year colleges will be offering distance-learning course, up from 58% in 1998." (p. 1). In addition, the IDC (1999) states that the "number of college students enrolled in distance-learning courses will reach 2.2 million in 2002, up from 710,000 in 1998." (p. 1). This growth is not surprising since many demographic measures indicate that higher education will be one of the growth industries for several decades. One reason given for this is that the traditional "age cohort is expanding (perhaps adding as many as two million students over the next decade, but even more important, older and employed learners will add more than twenty million students to the enrollment pool." (Munitz, 2000, p. 14). This increase in the enrollment pool may stretch the traditional institution's facilities and faculty. Looking to the future, an institution will not reduce traditional on-campus programs to meet the demand. Instead, they will expand their market using alternative delivery systems to reach outside of their traditional geographic service area. These technology-based delivery systems, especially the Internet, will "fundamentally alter how colleges and universities conduct the business of higher education, how professors teach, and how students learn." (Clague, 1999, p. 45).

While there will always be a need for classroom interaction, a question being raised is whether to continue investing in cable television technology used in delivering telecourses, invest in web-based delivery systems or both. A report released in

December, 1999 from the National Center for Education Statistics identified the types of technology that are being used as a primary mode of delivery for instruction offered at a distance. "The results indicated that the top three technologies were "Internet courses using asynchronous computer-based instruction" (58%), "two-way interactive video" (54%), and "one-way pre-recorded video" (47%)." (Boettcher, 2000, p. 40). These numbers are in line with a recent research technology survey conducted by Forrester Research, Inc. of Cambridge, MA. While they found that university students and community college students use computers extensively in completing assignments, they did note an interesting divergence. "Watching television was the activity community college students were most likely to do less because they were on the World Wide Web" (Garcia, 2000, p. 16).

Non-traditional students have often been the normal audience for distance learning efforts (Roberts, 1996) although "motivated students learn not from the medium or system used, but in spite of it" (Wilkes & Burnham, 1991, p. 43). Some distance learning demographic research indicates that "the independent study population has shifted towards younger students, local residence, and full-time course loads that combine independent study with on-campus courses." (Wallace, 1996, p. 1). This younger age group takes the Internet for granted and "are not content to assimilate information passively but are used to interacting with it, responding to it, and giving it new shape and meaning." (Munitz, 2000, p. 17). This younger, traditional college-age group may take the Internet for granted, but overall student demographics indicate that "the majority of American college and university students will be older than

25.... They are working adults, parents, serious (if part-time) students, and citizens who actually vote." (Langenberg, 1999, p. 16). While the Internet is mentioned, one study described the "successful telecourse student as being over 25 years-old and married (Dille & Mezack, 1991) and female (Oxford et al., 1993)." (Bink, Biner, Huffman, Geer & Dean, 1995, p. 15). This data is further supported by studies conducted at Howard Community College in Columbia, MD. It indicated gender may also be a key factor in choosing a distance learning option and found that "80.2% of the telecourse students" (Easterday, 1997, p. 33) were female.

A challenge to distance education programs is how to meet the needs of students from widely diverse age and economic groups. A recent survey conducted by the U.S. Department of Education's National Center for Educational Statistics found that the number of distance education programs had increased by 72% from 1994-95 to 1997-98 (Institute for Higher Education Policy, 2000, p. 1). This rapid growth is due mostly to the explosion in Internet-based distance education offerings and that "public institutions are going into distance education much faster than private institutions." (Carnevale, 2000b, p. A57). Expanding course offerings and reaching new students is a positive trend. Still, there is a growing concern from faculty and administration regarding student success and dropout rates for distance students. Currently distance students have higher dropout rates than classroom students. Two identified consistent needs for web-based and telecourse students to achieve success include quick feedback to queries as well as tests and clear communication from the instructor. One study of telecourse students reported that "course completion rates jumped from 69%

to 91% when assignment turn-around time was decreased only 2.7 days, from 8.3 to 5.6 days." (Bink, et al., 1995, p. 18).

Higher education must provide distance students with services, support and learning opportunities that fit their life style and work needs while addressing issues that impede their academic success. "Technology should be used to provide the tools to create this student-centered environment, but delivery processes and philosophies will also be transformed to leverage technology and fully implement new service models." (Beede & Burnett, 1998, p. 71). There have been published principles and guidelines regarding the development of technology-based education and training, notably Alessi and Trollip (1991), Floyd (1991), Science Applications International Corporation (1992), and Reynolds and Araya (1995), which all had a common base of instructional system design as described by Dick and Carey (1985). To create an environment where learning and productivity can be combined and optimized, technology must be utilized (Marquardt & Kearsley, 1999) and incorporated into the collaborative learning experience. "The real value of collaborative learning emerges when the professor, instead of treating it simply as an adjunct to the class, integrates the concept into the pedagogy of the course." (Pinheiro, 1998, p. 121).

In a effort to focus on the development pedagogy, delivery processes, and the creation of the student-centered environment identified for student success, a study was recently commissioned by the National Education Association, a professional association for faculty in higher education, and Blackboard, Inc., a provider of web-based course

development tools. Together they commissioned the Institute for Higher Education Policy to examine, validate and redefine the principles and guidelines with specific attention to Internet-based distance education. This study included a comprehensive institution, a virtual institution, a research institution, and a community college. This study resulted in twenty-four essential benchmarks for quality distance education programs especially ones that are Internet-based. They are:

Institutional Support Benchmarks

- A documented technology plan that includes electronic security measures (i.e., password protection, encryption, back-up systems) is in place and operational to ensure both quality standards and the integrity and validity of information.
- The reliability of the technology delivery system is as failsafe as possible.
- A centralized system provides support for building and maintaining the distance education infrastructure.

Course Development Benchmarks

- Guidelines regarding minimum standards are used for course development, design, and delivery, while learning outcomes - not the availability of existing technology - determine the technology being used to deliver course content.
- Instructional materials are reviewed periodically to ensure they meet program standards.
- Courses are designed to require students to engage themselves in analysis, synthesis, and evaluation as part of their course and program requirements.

Teaching/Learning Benchmarks

- Student interaction with faculty and other students is an essential characteristic and is facilitated through a variety of ways, including voice-mail and e-mail.

- Feedback to student assignments and questions is constructive and provided in a timely manner.

- Students are instructed in the proper methods of effective research, including the assessment of the validity of resources.

Course Structure Benchmarks

- Before starting an online program, students are advised about the program to determine (1) if they possess the self-motivation and commitment to learn at a distance and (2) if they have access to the minimal technology required by the course design.

- Students are provided with supplemental course information that outlines course objectives, concepts, ideas, and learning outcomes for each course are summarized in a clearly written, straightforward statement.

- Students have access to sufficient library resources that include a "virtual library" accessible though the World Wide Web.

- Faculty and students agree upon expectations regarding times for student assignment completion and faculty response.

Student Support Benchmarks

- Students receive information about programs, including admission requirements, tuition and fees, books and supplies, technical and proctoring requirements, and student support services.

- Students are provided with hands-on training and information to aid them in securing material though electronic databases, interlibrary loans, government archives, news services, and other sources.

- Throughout the duration of the course/program, students have access to technical assistance including detailed instructions regarding the electronic media used, practice sessions prior to the beginning of the course, and convenient access to technical support staff.

- Questions directed to student service personnel are answered accurately and quickly, with a structured system in place to address student complaints.

Faculty Support Benchmarks

- Technical assistance in course development is available to faculty, who are encouraged to use it.

- Faculty members are assisted in the transition from classroom teaching to online instruction and are assessed during the process.
- Instructor training and assistance, including peer mentoring, continues through the progression of the online course.
- Faculty members are provided with written resources to deal with issues arising from student use of electronically accessed data.

Evaluation and Assessment Benchmarks

- The program's educational effectiveness and teaching/learning process is assessed though an evaluation process that uses several methods and applies specific standards.
- Data on enrollment, costs, and successful/innovative uses of technology are used to evaluate program effectiveness.
- Intended learning outcomes are reviewed regularly to ensure clarity, utility, and appropriateness.

(Institute for Higher Education Policy, 2000, p. 2, 3).

One interesting point is that these benchmarks are very similar to the requirements described in the Guidelines for Distance Education, Appendix L, written by the North Central Association (NCA) of Colleges and Schools and whose final draft the Commission on Institutions of Higher Education approved in January 1998. This accrediting organization reflects the changes in how distance education students are being viewed by the various governing bodies. These changes include allowing greater flexibility in awarding financial aid, yet require stricter assessment of distance education programs by regional accrediting associations such as the NCA.

A report prepared for the Council for Higher Education Accreditation supports the efforts of distance education providers to make instruction learner-centered which is defined by three basic qualities, "instruction is largely self-directed; it is more focused

and purposeful; and it employs the appropriate level of faculty mediation." (Phipps, Wellman & Merisotis, 1998, p. 1). A recent study raises the question of what type and level of faculty contact is appropriate. Ruth and Bill Maki teach psychology at Texas Tech University in Lubbock, TX. For the last two and a half years they have offered a web-based and a traditional version of an introduction to psychology course. While the web-based students "have consistently scored an average of five percentage points higher on the final exam.... [they have] just as consistently...reported they are less satisfied with the course" (Carr, 2000, p. 1). The authors state that while the web allowed them to provide students with immediate and individualized feedback, they identified that web-based students were required to complete weekly quizzes and assignments in place of the lecture sections which increased their time investment to this course. It was observed that students rated the web course as having more work which was true since these students were given deadlines more often by design (Carr, 2000, p. 1).

A group of studies conducted at Ball State University bring common student needs together for a successful distance education experience. Timely interaction with the faculty is identified as a high value for the learning experience. For example, "student's satisfaction with the promptness of test/paper grading turnaround times was found to be strongly predictive of their telecourse performance." (Biner & Dean, 1995, p. 1). Robert Chase, President of the National Educational Association, stated that "distance learning can be quality learning only if colleges and universities recognize the needs of the student" (Carnevale, 2000a, p. 1) and that included agreement upon "expectations

regarding times for student assignment completion and faculty response." (Institute for Higher Education Policy, 2000, p. 3).

Telecourse

Telecourse programming has coexisted with traditional, lecture-based offerings since the early 1980s in many institutions. The review of literature identified that distance learning in a community college setting, especially telecourses, "accommodates nontraditional learners and students living in rural settings, primarily employing low-end technology in its outreach service." (Swienciki, 1996, p. 179). In a study conducted at Calhoun Community College, it was found that there was no significant difference between telecourse students and traditional classroom students (Searcy, Howton & Yarbrough, 1993) supporting previous research as well (Chu & Schramm, 1979; Wilkinson, 1980). Telecourses offered via cable are very cost effective since these "programs can be viewed by an unlimited number of people within a broadcast area without affecting the delivery cost." (Marquardt & Kearsley, 1999, p. 88).

This technology is very stable and many "educators view the telecourse-delivery system as a way of reaching new groups of potential students. Others see the telecourse delivery system as a college-entry option for students who are intimidated by traditional classroom instructional experiences." (Willett, 1986, p. 33). However, "it appears that some educators are allowing a collective enthusiasm for integrating low-end technology to obscure the fact that, instead of providing a solid introduction

to a discipline we are encouraging introductory students to isolate themselves in their homes and attempt to master fields of knowledge from within what can be a video vacuum." (Swienciki, 1996, p. 180). Brown (1988) stated that, "All things being equal, face-to-face interaction is the preferred learning mode for most people. Television viewing represents passive learning and participants' cognitive engagement appears to wane over extended periods of viewing time" (p. 9). Telecourses do separate the student from the instructor and from other students thereby creating an educational experience that "impersonalizes instruction, and that distance learning threatens faculty control of the curriculum and instruction." (Easterday, 1997, p. 25).

A study conducted by Brillantes in 1990 found one key difference between telecourses compared to traditional classes specifically that telecourses had no presence of humor (McNabb, 1994, p. 39). One study found that that while "some may claim that telecourses depersonalize education, it might also be argued that they minimize the potential for instructor bias towards the more socially skilled." (Pugliese, 1994, p. 34). Others provided the opinion that "some may argue that TV as a means of instruction creates passivity in the learning process, the counter argument is that using the media can help create active learners." (Klinger & Connet, 1992, p. 90). There is literature that supports the conclusion that telecourses are an effective method of delivering instruction to remote students who do not have convenient face-to-face access to the course (Livieratos, 1990; McNabb, 1994). Easterday (1997) reported that students believed that telecourses provided greater flexibility of learning than traditional classroom courses.

The convenience factor for students may be pivotal for the success of a telecourse delivery system even though it may not meet the institution's goal of attracting and enrolling new students. One study at a community college in North Carolina identified that "telecourse students were not a new population of students but were predominately a traditional group of students using telecourses to supplement their traditional college loads." (Willett, 1986, p. 35). This age group may not be as well suited to taking telecourses and this study identified age as a key statistic to determine if there is a correlation between success and distance technologies. Telecourse studies have identified high dropout rates compared to classroom rates for many years (Purdy, 1986; Searcy et al. 1993; Hammond, 1997). This rate may be "due to immature students who are unable to handle the greater autonomy of distance learners." (Easterday, 1997, p. 30).

The ability to control the pace of learning as well as the time of study (Leach & Webb, 1993) are important factors to many students, especially those who may have professional or personal commitments but want to accomplish their academic goals in a timely fashion (Easterday, 1997). "In studies of telecourse students, Brey and Grigsby (1984) and Crane (1985) found that for some students, the opportunity to learn at home or to try a new learning method were important reasons why they became distance learners." (Wallace, 1996, p. 8). Older students have found flexibility a key attribute to taking courses and " adult part-time students, who may feel uncomfortable in a classroom with younger students, found distance learning appealing." (Easterday, 1997, p. 25). Telecourse students at Lakeland Community

College can obtain, at a nominal fee, complete videotape sets of the telecourse thereby supporting research that students prefer having the video materials at their home (Anagal, et al., 1996). "Perhaps students have a feeling of having more control over their learning experience when they have more control over where and when they watch telecourse lectures." (Hammond, 1997, p. 11).

Web-based

Instruction delivered through a computer is not as new as some pundits might lead us to believe. In 1952 an early UNIVAC computer helped predict the outcome of the presidential race and many educators saw the "potential for using computers in education and the dream of the 50s was that college classrooms would be connected to computers which would serve as patient tutors, scrupulous examiners and tireless schedulers of instruction." (Alexander, 1995, p. 2).

There have been a number of comparison studies between traditional classroom instruction and a form of computer-based instruction (CBI). Some studies found that "students using CBI achieved results which were on the average between about a quarter and a third of a standard deviation higher than those for the control group" (Alexander, 1995, p. 2). Thomas Russell's 1999 compilation reported an overwhelming number of studies that found no significant difference in traditional to computer or other technology-based delivery systems. The role of the instructor was also a vital part of the studies. For example, in the earlier studies previously noted, it

was reported that "the learning gains reported above virtually disappeared when the same instructor taught both the control group and the experimental group (i.e. designed the CBI program)." (Alexander, 1995, p. 2, 3).

The introduction of the personal computer to the business community and the consumer in the early 1980s and the emergence of the World Wide Web in the mid-1990s has "ushered in an entirely new era in computing. The web is 'just' another Internet application but one so powerful that it has transformed the way the Internet (and computers overall) are being used." (Marquardt & Kearsley, 1999, p. 195). The rapid growth and use of these technologies is occurring at a pace that is difficult to understand for the consumer and at a price that is overwhelming to an academic institution. In a 1997 appearance before the U.S. Senate Committee on Labor and Human Resources, William Wulf, professor of engineering and applied science at the University of Virginia, stated:

> One of the hardest things for most people to understand is the effect of information technology's exponential rate of improvement. For the last four decades, the speed and storage capacity of computers have doubled every 18 - 24 months; the cost, size, and power consumption have become smaller at about the same rate. The bandwidth of computer networks has increased a thousand-fold in just the last decade, and the traffic on the network continues to grow at 300 - 500 percent annually. For the foreseeable future, all of these trends will continue; the basic technology to support their continued advance exists now.
>
> (as cited in Institute for Higher Education Policy, 1999, p. 29).

A greater number of institutions are offering courses in a web-based format; an estimated 10,000 courses are available according to the U.S. Department of Education's National Center for Educational Statistics (Acebo, Burrus & Kanter,

1998). The growing number of course offerings indicates that technology can "provide distance learning where the instructor and/or training source is some distance (a few hundred feet or 10,000 miles) from the learners." (Marquardt & Kearlsey, 1999, p. 62). "The web is well-suited to disseminating knowledge. It can deliver training on demand, while also easing administrative and logistical headaches." (Behan, 1999, p. 1). Specifically, institutions "everywhere are exploring ways to use technology to connect students more effectively with faculty, counselors, other students, and appropriate services and information resources." (Acebo, Burrus & Kanter, 1998, p. 14). A question remains as to whether this type of delivery system is effective and whether it is able to meet the expectation that institutions, and students, are placing on it. Terry O'Banion, President Emeritus of the League for Innovation, recently stated that "while there is great potential, Internet-based learning also holds the promise of making already terrible instruction that much more available." (Milliron & Miles, 2000, p. 2).

One recent study at California Polytechnic State University at San Luis Obispo found that interactive multimedia is allowing students to succeed in a key topic area. This study tracked 271 students who enrolled in a traditional, lecture-based, precalculus course. The study identified that students who had previously completed an online, or non-traditional, interactive course in intermediate algebra were more successful in the precalculus course than the students who had taken intermediate algebra in a classroom. "The students who took the nontraditional algebra course earned 49 percent more A's,

B's, or C's [sic] in precalculus than did the students who completed the classroom algebra course." (Olsen, 2000, p. 1)

Another study came to the conclusion that "on-line students' performance was quite comparable to, and in some cases excelled, that of their classroom counterparts." (Ridley & Sammour, 1996, p. 338). Jerald Schutte, an instructor at California State University, Northridge, conducted an experimental study where nineteen students appeared in his Social Statistics traditional class and eighteen appeared in the same class taught via the web. "Contrary to the proposed hypotheses, quantitative results demonstrated the virtual class scored an average of 20% higher than the traditional class on both examinations." (Schutte, 1997, p. 1). This study included an attitude survey and discovered the web-based students felt they spent more time on classwork compared to their traditional counterparts yet "they were also more likely to think they had more flexibility, a greater understanding of the material, and a more positive affect toward math, in the end, than did the traditional class." (Schutte, 1997, p. 3).

A vital statistic this study looked at was the age of the student. Various studies previously identified issues related to distance learning ranging from technology to communication as barriers. How these barriers and the age of the student affect course completion is an on-going concern. "Carr and Ledwith (1980) reported that student occupation, age and gender were related to dropout rates in distance education courses" (as cited in Bink, et al., 1995, p. 15) and technology adds additional variables to the distant student's learning experience. For example, technology issues may frustrate an

older student who has not had extensive experience using computers and the Internet. The mature student "may appreciate the flexibility of an online course more than the typical undergraduate" (Ridley & Sammour, 1996, p. 339) and have a higher degree of self-discipline to stay on pace to complete assignments and not wait until the end of the term.

A recent study discovered negative experiences that included technical problems yet identified personal communication needs having a deeper, negative, impact to the student's learning experience. The student focus of this web-based program was a graduate course of study and the frustrations expressed were because "of a lack of immediate feedback from the instructor and ambiguous instructions on the web and via e-mail." (Hara & Kling, 1999, p. 18). In the study conducted at California State University, Northridge, students enrolled in the web-based class expressed frustration from their inability to ask the professor questions in a quick, real-time experience. This study found that the web-based students compensated for this interaction by creating "more involvement between and among peers, who formulated study groups to 'pick up the slack of not having a real classroom'." (Schutte, 1997, p. 3).

Interaction with the instructor, or the lack of it, is a common issue raised by web-based students. Dr. Tom Kubala, University of Central Florida, has been teaching several graduate level, web-based courses since the fall semester of 1996. Dr. Kubala (1998) reported positive statements made by students to him consistently include the individualized feedback, personal enjoyment of not traveling to campus and being able

to be flexible in terms of time. Concerns raised include the loss of classmate interaction, a degree of discomfort in participating in an open forum online and technology support issues ranging from difficulties with the student's Internet Service Provider to unfamiliarity with the web-based system.

The ease of access from the student's perspective and the relative ease of production from the college's perspective make web-based distance education very appealing. This type of technology delivery system allows institutions of all sizes to compete equally in providing a quality product. The technology can allow the creation of a highly interactive program and the ability to allow the student an active role in the learning process. The growth of the Internet and its acceptance into the home has spurred educational institutions to adopt these technologies "because they more quickly and easily increase an educator's capacity to help students make connections - particularly connections to content, context, and community - that result in more powerful learning experiences overall." (Milliron & Miles, 2000, p. 2).

Cost & Performance

Institutions looking to the future are planning for their growth and survival. "Ten years from now, more than 25 million people will be registered for post-secondary learning experiences in the United States alone" (Twigg, 1999, p. 13). Many of these future students will look to learning options in their community because "they will be seeking updated skills and knowledge to obtain better jobs or to perform more

effectively in their current positions." (Twigg, 1999, 13-14). Business and industry are planning on technology-based systems to increase worker knowledge and productivity. "More than half (55%) of respondents to InformationWeek Research's survey of 300 IT executives rank distance learning as a key business priority this year." (Mottl, 2000, p. 1). Learning at a distance is quickly becoming the "norm" for businesses as Ed Kilroy, general manager of E-commerce for IBM's software group states that, "Timeless, 24-by-7 access to information is becoming the standard way of doing business." (as cited in Wilder & McGee, 2000, p. 46). Barbara Epstein, site manager of the Physick House in Philadelphia, needed instruction in computer applications and chose a web-based option and observed that web-based courses are more cost effective than video and more time effective than classroom-based software courses (Phillips, 1998, p. 41). There is an increase in the ease of the tools used to develop and deliver instruction at a distance cited by Marquardt and Kearsley (1999). This knowledge combined with simplicity in developing and maintaining the applications and support systems is providing many organizations with a rationale to implement technology-based solutions to obtain additional savings in terms of cost and time.

Business leaders understand the savings of time and fiscal resources in using distance education. "In analyses of several case studies of businesses that have benefited from using distance education to offer inservice training to employees, both Merrick and Phillips demonstrated that Internet-based educational programs can be delivered in a cost-effective, flexible and accessible manner." (Ellis, 1998, p. 14). The use of

technology-based systems to distribute and deliver training and instructional content to learners anytime, as well as anywhere, is reported to be between 30% to 60% compared to traditional lecture-based systems (Marquardt & Kearsley, 1999, p. 61). Educational leadership teams understand the savings potential as well; the "Florida State University system expects online programs to save 40% of the cost of in-class programs" (Schulman & Sims, 1999, p. 54).

A challenge instructional teams face is how to deliver content effectively and efficiently using the technology. A course delivered via the Internet has been shown to be cost effective (Phillips, 1998; Thatch & Murphy, 1995) and provides options that make it an attractive teaching tool as well. "Well-designed and properly implemented, computer-assisted, independent learning systems are effective in increasing student learning at acceptable costs" (Doucette, 1994, p. 22). The rapid growth of computer systems capable of communicating at reasonably fast speeds allow audio, text, graphics, and even limited video to be seen in locations ranging from the office to the home inexpensively (Dyer, 1996). "Web-based education tools provide many ways to increase communication between class members and faculty, including discussion boards, chats, and e-mails." (Blackboard, 1998, p. 1). Many groups are beginning to report their experiences using web-based courses. Review of the literature indicates that web-based classes perform as well as face to face classes and have been found to provide satisfactory educational experiences (Sechrest, 1998). Institutions are discovering that web-based delivery systems can transmit instruction and provide forums to promote active exchanges between student and faculty as well as between

students. Active learners are "more willing to participate in class 'discussions' and other learning activities online as compared to the traditional mode of learning." (Kubala, 1998, p. 20). Kubala (1998) further stated that online students "are daring and confrontational regarding the expression of ideas." (p. 20).

However, costs must be factored into alternate delivery systems since instruction delivered traditionally, such as a lecture in a classroom, initially has a lower cost than instruction designed and delivered using technology (Ryan, 1997). Introducing technology involves many new members to the learning team (Kember & Mezger, 1990) including many support staff who have not been directly connected to the instructional process in the past. Overall, there is a learning curve starting with the instructor when interacting with diverse groups outside his or her normal environment. These groups, or design teams, include technical support staff, student support services, instructional designers and graphic designers. It is impossible for the instructor to be an expert on all matters relating to the planning and delivery of a course, a course design team "and the instructor - is needed for the development and implementation of a successful program" (Thach & Murphy, 1994, p. 6).

Some faculties have found that using technology is worth the investment for their students. One reference (Smith, 1993) compared a telecourse that was re-purposed into an interactive videodisc program. In this study it was discovered that "when students are tracked across their alternating learning conditions, it is clear that when they have access to interactive learning resources they do better - not much better, but

generally better." (Smith, 1993, p. 66). Online instructors at Christopher Newport University "rated student performance and learning in the areas related to general skills development significantly higher in online than in classroom courses" (Ridley & Sammour, 1996, p. 338). Sheryl O'Neill, coordinator of entry-level mathematics and mathematics placement exams for California Polytechnic State University at San Luis Obispo, observed that the passing grade rate had increased and that the students were doing at least as well, and possibly even better, in their college-level courses (Olsen, 2000, p. 1).

A study conducted at Christopher Newport University found that web-based course offerings impacted the institution's full time enrollment (FTE) confirming "that net FTE gain can accrue even when students overwhelmingly commute from inside the traditional service area." (Ridley et al., 1997, p. 16). However, the desire to increase student enrollment is moving academic institutions into the evolving world of web-based education (Arenson, 1998) using the Internet and "now the interactive media of computers and telecommunication in its attempts to extend the campus beyond traditional boundaries." (Swienciki, 1996, p. 179). This desire is driving the implementation of "new technologies which allow teachers to reach students in their homes and at their distance and often rural learning sites." (Hammond, 1997, p. 3). "Peterson's Guide reports that nearly 400 accredited colleges and universities in North America currently employ online instruction" (Schulman & Simms, 1999, p. 54).

Providing instruction in a manner that will allow students to perform better is a goal of both the institution and the faculty. With this goal of student performance in mind, it has been observed that community college students are becoming more accustomed to tools and services that provide access to information and they expect these systems to be a part of their educational experiences (Milliron & Miles, 1998). Technology, especially the Internet, has expanded the service area in which an institution can offer degrees and programs and is challenging many institutions' missions. "This means institutional leaders must assess the mission's relevance in light of the institution's capabilities and emerging technologies and consider the applications for restructuring or transforming the institution." (Twigg, 1999, p. 12). An ongoing goal for faculty and staff is to assist the institution's leadership in acquiring "the vision and direction to know when and how the use of technology is appropriate" (Eaton, 2000, p. 35) in order to benefit the student and to improve the programs being offered.

Industry has proven that technology-based delivery of instruction is cost effective (Muldoon, 1996; William & Stahl, 1996), but the educational institutions need to know when and which technology to use to meet the learner's needs. Learner-centered systems speak of using technology effectively (O'Banion, 1997) in order to create an environment where students can "gain access to information, to interpret it, to give it context, to use information to solve problems, and to collaborate with others in problem solution." (Doucette, 1994, p. 23). Meeting the wide range of academic needs is the goal of an effective learning program and academic institution.

Information gathered from the literature review and various studies indicate that

teaching and studying at a distance is effective when measured by the achievement of learning, by the attitudes of students and teachers, and by the cost effectiveness. This is especially true when the delivery system involves a media-based, interactive telecommunications tool (Institute for Higher Education Policy, 1999, p. 22).

Summary

A review of the literature suggests that distance learning is different from the traditional, classroom-based delivery system. Its differences appear in the design as well as the delivery of the instruction to the student. While the design issues are reflected in the enhanced guidelines for course development, the specific issues that impact a delivery system for reaching students at a distance effectively were not clearly articulated.

There was evidence in the literature suggesting that the effectiveness of telecourses and even web-based courses were comparable to traditional classroom offerings. There were indicators that identified areas of concern raised by students that should be explored by institutional leadership prior to a delivery system's implementation especially in the attitudes and opinions of the students. While there are studies such as Russell's (1999) that indicate technology-based delivery systems do not seem to have a significant difference on the instructional process, the variables of clarity and communication, among others, need to be further explored and articulated.

Many of the studies reviewed based the effectiveness of the delivery system upon the cognitive achievement as shown by the results of the final test. This study addressed these attitudinal variables in order to analyze where technology and its required support systems should be focused. The affective experiences a student learning at a distance encounters may differ in key areas from the traditional classroom student. The results obtained from this study can provide support and direction that ultimately can be used for establishing implementation guidelines. The primary contribution of this research is the data that can assist institutions in making distance technology recommendations. Technology implementation options, such as a telecourse system or a web-based delivery program, should include information based upon the findings of this study and the analysis of the data collected.

Chapter 3

Methodology

Introduction

This chapter describes an overview of the research methodology used in developing this study. The chapter includes the research design, assumptions made, the variables within the study, a description of the population, the sample, the instrumentation, data collection, the control for extraneous variables, data analysis, and final summary.

Research Design

The goal of this research was to compare and evaluate three different instructional delivery systems in terms of performance, overall final course grades, and attitude towards the delivery system. The hypothesis of this research was that there was no significant difference among the classroom-based lecture course; the video-based telecourse; or the online, web-based course in terms of performance as measured by overall final course grade and attitude as measured by survey response.

The research project is based on a quasi-experimental design, which is appropriate when it is not possible to randomly assign students to the groups being studied (Best & Kahn, 1986). While this design compromised some of the specific guidelines of a

controlled experiment, it did maintain the argument and logic of experimental research. "This design is often used in classroom experiments when experimental and control groups are such naturally assembled groups as intact classes" (Best & Kahn, 1986, p. 129). With the quasi-experimental approach, the evaluation process was important as well since "this design may be the only feasible one, the comparison is justifiable, but the results should be interpreted cautiously." (Best & Kahn, 1986, p. 129). The Chi Square test was used to evaluate independent variables such as visual, auditory, and technical issues in the attitudinal survey since it is often used to estimate the possibility that "some factor other than chance (sampling error) accounts for the apparent relationship." (Best & Kahn, 1986, p. 286). The results of the Chi Square test were correlated to the overall final course grades in each of the instructional delivery systems. Correlation "is the relationship between two or more paired variables or two or more sets of data." (Best & Kahn, 1986, p. 229). In addition a group-comparison design was used in the ANOVA analysis. This design was appropriate for the manipulation of variables such as gender, age, and grades that were also a part of this study. "Group-comparison designs are more appropriate than correlation designs when the independent variables are natural categories (e.g., gender)" (Cone & Foster, 1993, p. 177).

Assumptions & Limitations

The following assumptions and limitations were given as a part of this research:

1. The students chose a delivery system that they were comfortable with, were able to use, and were able to easily access introducing a favorable bias towards that method of delivery.
2. The students who chose to participate in this study were volunteers and were from the existing Lakeland Community College registration pool. It was assumed that their responses to the survey were honest representations and the grades reported were accurate.
3. The participants of this study followed accepted procedures and directions regarding admissions, registration, and schedule changes as described in the Lakeland Community College course schedule book.
4. The course of study used was Math 155, Introduction to Statistics. Since it was the only content topic in this research, generalizations to other subject areas may be limited, even in similar conditions.

Variables in the Study

The independent variable in this study was the instructional delivery system used by the student to gain access to the course content whether a classroom-based lecture; the video-based telecourse; or the online, web-based course of instruction. An extraneous variable was the use of additional faculty to teach a classroom section of the course of instruction, Math 155, Introduction to Statistics. The additional faculty used the same lesson plan, textbook, and exams developed and used by the initial

instructor, Mr. Donald Davis. The age and gender of each student was an attribute independent variable. The dependent variables in this study were the students' pre-test score, their overall final course grade, and the responses from the attitudinal survey administered at the end of the term.

Population

The population studied was composed of students taking Math 155, Introduction to Statistics, during the academic year 1999 - 2000 at Lakeland Community College, Kirtland, OH.

Sample

For the purpose of this study, the sample was composed of all students who enrolled in the Math 155, Introduction to Statistics, course during the academic year 1999 - 2000 at Lakeland Community College and who completed the pre-test and final exam. An attitudinal survey was administered at the end of the course and results of this voluntary response were used in the detailed analysis. The number of survey responses equaled 73% of the sample group and this was determined to be valid for the purposes of this study that had proposed a valid rate of response as two-thirds of the sample group. This course was scheduled to be offered via all three instructional delivery systems being studied during the Fall 1999, Winter 2000, and Spring 2000 quarters. It was anticipated that each section of the class had a class size no smaller than ten and that the total potential sample size could be as large as ninety.

The students in this population were provided instruction in the following methods:

1. Classroom-based lecture. Students who chose this delivery system were taught in a regular classroom on the Lakeland campus. The instructor was always present at the time and day as described in the course catalog. The instructor posted office hours and email and phone-mail were available for additional communication with the students. The curriculum and course outline for this section was the same for all instructional delivery systems being studied as defined by the Lakeland Curriculum Committee and Office of Academic Affairs.
2. Video-based telecourse. Students who chose this delivery system attended one orientation session, a mid-term exam and a final exam on the college campus. The instructor administered the orientation session at a time and location as described in the course catalog. The mid-term and final exams were offered in the testing center and were taken within a defined week as noted in the syllabus. The instruction was delivered on a published schedule via the video-based Lakeland Cable Network over the length of the term. In addition, each student had the option of obtaining the entire series of videotapes in the college Bookstore or in the Library for viewing and reviewing at their own discretion. The instructor posted office hours and email and phone-mail were available for additional communication with the students.
3. Web-based. Students who chose this delivery system attended one orientation session, a mid-term exam and a final exam on the college campus. The instructor administered the orientation session at a time and location as described in the course catalog. The mid-term and final exams were offered in the testing center

and were taken within a defined week as noted in the syllabus. The instruction was delivered via the web-based Lakeland Knowledge Network (http://lkn.lakeland.cc.oh.us/courses) over the length of the term. The web-based application tool used by the college is CourseInfo provided by Blackboard, Inc. The instruction included interaction with the instructor via e-mail and discussion groups, as well as posted office hours and phone-mail.

Instrumentation

During the first class and/or orientation session, each student in the Math 155 class was asked to volunteer to participate in this study. A script was provided to the instructor describing the study. After the script, Appendix A, was read, it was followed by a pre-test, Appendix B. This pre-test score was used as a part of the data analysis and was reported in the results as a part of this study. At the end of the term each student took a final exam. The classroom final was a comprehensive exam while the telecourse and the web-based course were not comprehensive exams. These exams were designed and implemented by the initial instructor, Mr. Donald Davis of Lakeland Community College. He has taught in all three delivery systems, has years of practical experience and used the final exams, as noted above, for over three years to match the textbook and course syllabi. The final exam grade was included as a part of the overall class grade that was used as a part of this study. At the time of the final exam the instructor described how the overall class grade and the survey data were used in this study in a script provided to the instructor, Appendix C. The initial instructor designed the pre-test around the content outline

used in all delivery systems while the researcher authored the scripts. At the end of the term an attitudinal survey, Appendix D, was given. This survey asked students a wide range of questions covering four topic areas: demographic information, technological sophistication, course evaluation, and resources for learning. This survey also included space for additional comments from the student.

The attitudinal survey was adapted from one used at Clark College, Vancouver, WA (http://www.clark.edu). With the permission of Susan J. Wolff, Associate Dean of Instruction, this survey was posted online and printed for distribution for all students regardless of the instructional delivery systems being studied. It had been piloted for use in this study and for distance learning evaluations by Lakeland during the summer quarters of 1999 and was approved for Lakeland's use by the Vice President for Academic Affairs, Dr. Ruth Zollinger, prior to the Fall 1999 quarter (personal communications, September 9, 1999). It was given to students at the time of their final exam in written format.

Data Collection

Data was collected during the three quarters of the academic year 1999 - 2000. The instructor during the first and/or orientation class proctored the pre-tests. The instructor for the lecture-based classroom proctored the final exam and attitudinal survey. The instructor, or a proctor in the learning center, administered the final exam and attitudinal survey for the video-based telecourse and online, web-based class.

Student participation was completely voluntary and names were used only to ensure the matching of the pre-test, overall final course grade, and attitudinal survey. As the scripts described, the results of this study were published without names attached after the data was collected and were presented as a combination of all sections during the academic year. All research involving the students was done in accordance with policies defined by Nova Southeastern University's Institutional Review Board and Lakeland Community College's Academic Affairs Division.

Control for Extraneous Variables

Statistical control was used to obtain meaningful results when experimental control was not possible. Best and Kahn (1986) stated that the "use of pretest mean scores as covariants is considered preferable to the conventional matching of groups." (p. 118); however, this use was evaluated once the data was collected and reviewed and determined to be appropriate. Gathering data from individual observations and tests can be combined to make group generalizations possible and this can be achieved by measuring one or more variables in addition to the independent variables of primary interest and by controlling the variation attributed to these variables though statistical analysis.

An analysis of covariance (ANCOVA) "used to equate groups on one or more variables" (Gay, 1992, p. 290) was used. "The use of pretest mean scores as covariants is considered preferable to the conventional matching of groups." (Best & Kahn, 1986, p. 118). While the t test was used to determine whether the results of

data samples were too different to attribute to chance or sampling error, the "analysis of variance is an effective way to determine whether the mean of *more than two samples* are too different to attribute to sampling error." (Best & Kahn, 1986, p. 275). The analysis of variance (ANOVA) is a statistical method used to equate groups on one or more variables. It is often suggested that both these methods, ANCOVA and ANOVA, use a "nonmanipulated variable [that] is often referred to as a control variable." (Gay, 1992, p. 331) or covariate. Each student's pre-test score was used as the covariate in this study allowing ANCOVA to compare adjusted scores. Caution was used since the "ANCOVA only makes sense if there is a significant correlation between the covariate and the dependent variable being analyzed." (Cone & Foster, 1993, p. 186).

Data Analysis

The data analysis for this research included measured parametric data, such as grades, and ranked nonparametric data, such as the attitudinal survey. "Because most real world outcomes are the result of a number of factors acting in combination, most significant experimentation involves the analysis of the interaction of a number of variable relationships." (Best & Kahn, 1986, p. 137). The factorial design was a 3 x 2 x 2 analysis of covariance with one covariate (ANCOVA). This type of analysis uses the "principles of partial correlation with analysis of variance. It is particularly appropriate when the subjects in two or more groups are found to differ on a pretest or other initial variable." (Best & Kahn, 1986, p. 281). The first factor was the instructional delivery system (lecture class, telecourse, and web-based), the

second factor was gender, and the third factor was age. For the purposes of this analysis the students were defined as either traditional age (under the age of 22) or non-traditional age (22 years and older). The dependent variable used in this analysis was the overall final course grade while the control variable, covariate, used was the students' pre-test score. A dependent variable is used in evaluating the existence of possible group differences while a covariate is often used in order to equate groups that might otherwise be nonequivalent and this covariate was chosen to control for possible pre-existing differences in the sample groups. The attitudinal survey responses were analyzed using the Chi Square test since it is often used to estimate the possibility that "some factor other than chance (sampling error) accounts for the apparent relationship. Because the null hypothesis states that there is no relationship (the variables are independent), the test merely evaluates the probability that the observed relationship results from chance." (Best & Kahn, 1986, p. 286). The results of the Chi Square test were correlated to the overall final course grades in each of the instructional delivery systems. Correlation "is the relationship between two or more paired variables or two or more sets of data." (Best & Kahn, 1986, p. 229). Finally the t test was used to conduct further analysis of survey responses. The t test is often used when "smaller sample size and greater variation within groups are associated with an expectation of greater random differences between groups." (Gay, 1992, p. 436). The t test is a valuable tool used in determining whether the difference that is observed is appropriately larger than a difference that could be expected from chance.

Summary

Chapter 3 identified the basic questions this research attempted to answer:

- Would there be a significant difference in student achievement as measured by overall final course grade related to the instructional delivery method?
- Was student achievement, as measured by overall final course grade, impacted by the age and gender of the traditional student compared to the age and gender of the non-traditional student regardless of delivery method?
- Did student satisfaction as measured by attitudes towards the chosen delivery method impact the overall final course grade?
- Did students feel that time and travel options provided by telecourse or web-based delivery systems impact and/or enhance their overall final course grades compared to the lecture delivery method?
- Did students feel that physical, mental, environmental and technical obstacles within their chosen learning environment impact and/or enhance their learning experience in terms of performance?

This research attempted to compare how different delivery systems impacted the learning experience as measured by the students' attitude as well as their overall final course grade.

Chapter 4

Data Analysis Results

Introduction

This chapter describes the results of the data gathered in this research. The chapter includes the results and analysis of the variables described previously in the research sample population. The focus of this research was to obtain increased knowledge of the instructional delivery system issues encountered by students as they learn a topic. Five research questions were addressed by this study.

The goal of this research is to compare and evaluate three different instructional delivery systems in terms of performance, final grades, and attitude towards the delivery system. The purpose is to determine if there are measurable differences between students taught in a classroom-based lecture course and either the video-based telecourse or an on-line, web-based course. The hypothesis of this research is that there is no significant difference. Six null hypotheses were tested in this research to determine the results. All testing for statistical significance was conducted using a level of significance, also known as an alpha level, of five percent (.05). This rate was chosen given that in "psychological and educational circles, the 5 percent [sic]

(.05) alpha (*a*) level of significance is often used as a standard for rejection." (Best & Kahn, 1986, p. 261).

In the analysis of data several terms are used to describe the results contained in the tables and are described below to assist in the discussion of the analysis.

- Age2. This heading was used to identify the ages being analyzed, traditional, and non-traditional.
- F. This term represents the ratio computed during the analysis of variance (ANOVA) process. If the F value is "substantially greater than one, it would seem that the ratio of the *between-groups variance* and the *within-groups variance* was probably too great to attribute to sampling error." (Best & Kahn, 1986, p. 276). This value indicates which values are "necessary to test the null hypothesis at selected levels of significance." (Best & Kahn, 1986, p. 276).
- Gender. This heading was used to identify the gender of the sample being analyzed.
- Mean. "The mean of a distribution is commonly understood as the arithmetic average." (Best & Kahn, 1986, p. 211).
- Pre_Cour. This heading was used to identify the pre-test scores obtained at the beginning of academic term in each instructional delivery system.
- Type_of_. This heading was used to identify the type of instructional delivery system.

During the analysis the tables indicate the types of testing being conducted using the terms above. For example, "Type_of_*Gender" indicates that the type of instructional delivery systems has been compared to each of the gender types.

This research compared traditional student achievement to non-traditional student achievement to determine if any differences in achievement could be based on age, gender, and the instructional delivery system. Student satisfaction, as measured by attitude towards the chosen instructional delivery system, was also compared to the overall final grade.

It should be noted that as a result of this research attention to the formal student tracking process has been identified as an area of potential weakness. It was identified at the end of this study that a faculty member had allowed one student to formally enroll and be graded in one section but participate in another that was taught by the same instructor. Analysis of the student's responses when compared to the sample group identified that 79% of the responses were within one standard deviation point which was determined to not have a statistical effect on the overall results of this research. However, this process should be closely monitored in future studies.

Students were graded on a letter-based score where an "A" was marked as a 4.0, a "B" was marked as a 3.0, a "C" was marked as a 2.0, a "D" was marked as a 1.0 and an "F" was marked as a 0.0. Table 1 identifies the overall mean average score for all three delivery systems using the final course grade that equaled 2.27. The difference

between this overall final course grade mean average and each of the three systems was .40 or less with the traditional, lecture-based section having a slightly higher final course grade average and the web-based section have a slightly lower final course grade average.

Table 1: Overall Final Course Grade by Delivery System

	N	Mean	Std. Deviation
Lecture	27	2.67	1.27
Telecourse	24	2.17	1.20
Web-based	27	1.96	.85
TOTAL	78	2.27	1.15

Research Question 1

Will there be a significant difference in student achievement as measured by overall final course grade related to the instructional delivery method?

Null Hypothesis 1
There is no significant difference in student achievement as measured by overall final course grade between telecourse, web-based or lecture-based delivery method.

The first research question and hypothesis was tested using an analysis of variance or ANOVA. The analysis of variance (ANOVA) is a statistical method used to equate groups on one or more variables. The results indicated that there was no significant difference in the final grade between the telecourse, web-based or lecture-based

instructional delivery system. It is often suggested that statistical methods, such as ANOVA, use a "nonmanipulated variable [that] is often referred to as a control variable." (Gay, 1992, p. 331) or covariate. This was deemed unnecessary after initial analysis showed that there was not a "significant correlation between the covariate and the dependent variable being analyzed." (Cone & Foster, 1993, p. 186). Table 2 presents the results of this analysis of the ANOVA to this hypothesis.

Table 2: Overall Final Course Grade

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	7.050	2	3.525	2.804	.067
Within Groups	94.296	75	1.257		
Total	101.346	77			

The significance value of .067 indicates that there is no significant difference in student achievement as measured by overall final course grade between telecourse, web-based or lecture-based delivery method. The value of this must be less than the alpha level of .05 for the groups to be considered statistically different. Therefore, null hypothesis 1 can not be rejected and implies that there is no difference in student achievement as measured by overall final course grade between telecourse, web-based or lecture-based delivery method.

Research Question 2

Is student achievement, as measured by overall final course grade, impacted by the age and gender of the traditional student compared to the age and gender of the non-traditional student regardless of delivery method?

Null Hypothesis 2
There is no significant difference in student achievement as measured by overall final course grade between traditional and non-traditional student between telecourse, web-based or lecture delivery method.

Null Hypothesis 3
There is no significant difference in student achievement as measured by overall final course grade and gender between telecourse, web-based or lecture delivery method.

Null Hypothesis 4
There is no significant difference in student achievement as measured by overall final course grade and gender between traditional and non-traditional student between telecourse, web-based or lecture delivery method.

The second research question and hypotheses were tested using a factorial design. "Because most real world outcomes are the result of a number of factors acting in combination, most significant experimentation involves the analysis of the interaction of a number of variable relationships." (Best & Kahn, 1986, p. 137). The factorial design is a 3 x 2 x 2 analysis of covariance with one covariate (ANCOVA). This type of analysis uses the "principles of partial correlation with analysis of variance. It is particularly appropriate when the subjects in two or more groups are found to differ

on a pretest or other initial variable." (Best & Kahn, 1986, p. 281). The first factor is the instructional delivery system (lecture class, telecourse, and web-based), the second factor is gender, and the third factor is age. For the purposes of this analysis the students were defined as either traditional age (under the age of 22) or non-traditional age (22 years and older). The dependent variable used in this analysis was the overall final course grade while the covariate used was the student's pre-test score. The control variable, covariate, was chosen to control for possible pre-existing differences in the sample groups. Table 3 presents the test between subjects' effects with the final course grade as the dependent variable and the results of this analysis to these hypotheses.

Table 3: Final Course Grade by Age, Gender & Delivery Method

Source		Type III Sum of Squares	Df	Mean Square	F	Sig.
PRE_COUR	Hypothesis	.160	1	.160	.118	.732
	Error	87.975	65	1.353		
TYPE_OF_	Hypothesis	6.232	2	3.116	846.761	1.000
	Error	1.478E-07	4.016E-05	3.680E-03		
GENDER	Hypothesis	2.573	1			
	Error					
AGE2	Hypothesis	.321	1			
	Error					
TYPE_OF_*GENDER	Hypothesis	1.045	2	.523	.830	.544
	Error	1.295	2.056	.630		
TYPE_OF_*AGE2	Hypothesis	.214	2	.107	.171	.854
	Error	1.253	2.004	.626		
GENDER*AGE2	Hypothesis	6.115E-03	1	6.115E-03	.009	.931
	Error	2.097	3.017	.695		
TYPE_OF_*GENDER *AGE2	Hypothesis	1.250	2	.625	.462	.632
	Error	87.975	65	1.353		

The significance value of 1.000 indicates no significant difference for the instructional delivery method between traditional and non-traditional age students using the pretest as a covariate. The covariate did not statistically impact the analysis and this analysis indicates no significant difference as measured by the final course grade. The significance value of .854 represents no significant difference between non-traditional and traditional age students and the delivery method as measured by their final grade. Therefore null hypothesis 2 can not be rejected. The significance value of .544 represents no significant difference between delivery type and gender as measured by their overall final course grade. Therefore null hypothesis 3 can not be rejected. The significance value of .931 indicates that there is no significant difference between gender and age groups as measured by their overall final course grade. Therefore null hypothesis 4 can not be rejected. One additional analysis resulted in a significance value of .632 that indicates no significant difference when gender, age, and instructional delivery system are compared to the overall final course grade.

Table 4 provides additional detail of this analysis between gender, age and the instructional delivery system. It is interesting to note that, as a generalization, females did better on the final course grade regardless of delivery system. This data supports prior research (Institute for Higher Education, 1999); however, this study found that the web-based, non-traditional age men scored slightly higher than their female counterparts, which was different than Ridley & Sammour's (1996) expectations regarding older students. While not statistically dramatic, further

research may want to include additional measures and options regarding older students (Munitz, 2000) who typically make up the community college population.

Table 4: Final Course Grade by Age & Gender

Type of Delivery	Gender	AGE2	Mean	Std. Deviation	N
Lecture	Male	Traditional	2.20	1.30	5
		Nontraditional	2.33	1.63	6
		Total	2.27	1.42	11
	Female	Traditional	3.00	1.15	7
		Nontraditional	2.89	1.17	9
		Total	2.94	1.12	16
	Total	Traditional	2.67	1.23	12
		Nontraditional	2.67	1.35	15
		Total	2.67	1.27	27
Telecourse	Male	Traditional	2.00	1.00	3
		Nontraditional	1.83	1.17	6
		Total	1.89	1.05	9
	Female	Traditional	2.00	.89	6
		Nontraditional	2.56	1.51	9
		Total	2.33	1.29	15
	Total	Traditional	2.00	.87	9
		Nontraditional	2.27	1.39	15
		Total	2.17	1.20	24
Web-based	Male	Traditional	1.60	1.52	5
		Nontraditional	2.14	.69	7
		Total	1.92	1.08	12
	Female	Traditional	2.00	.00	5
		Nontraditional	2.00	.82	10
		Total	2.00	.65	15
	Total	Traditional	1.80	1.03	10
		Nontraditional	2.06	.75	17
		Total	1.96	.85	27
Total	Male	Traditional	1.92	1.26	13
		Nontraditional	2.11	1.15	19
		Total	2.03	1.18	32
	Female	Traditional	2.39	.98	18
		Nontraditional	2.46	1.20	28
		Total	2.43	1.11	46
	Total	Traditional	2.19	1.11	31
		Nontraditional	2.32	1.18	47
		Total	2.27	1.15	78

Research Question 3

Does student satisfaction as measured by attitudes towards the chosen delivery method impact the final grade?

Null Hypothesis 5
There is no significant difference in student achievement as measured by attitudes between telecourse, web-based or lecture delivery method.

A series of ANOVA tests were applied to this research question and hypothesis since the results are based upon the survey and used a factorial design. "If a research study is based upon a factorial design and investigates two or more independent variables and the interaction between them, the appropriate statistical analysis is a factorial, or multifactor, analysis of covariance." (Gay, 1992, p. 439). Specific sections of the survey, Appendix D, were averaged and then compared to the student's overall final course grade. Section 2 of the survey asked the students to identify their perception of their personal level of technological sophistication, which was then compared to their overall final course grade. Section 3 asked the students to evaluate the course in terms of mode of delivery and presentation concerns. This was then compared to the final course grade. Section 4 asked the students to identify their perception of the resources available to them ranging from library resources to student services.

There were several areas noted where values of significance were identified; however, these areas indicated differences in perception and did not relate to their final course grade. Overall the analysis of these sections indicated that there was no

significant statistical difference in student achievement as measured by attitudes between the instructional delivery systems. Therefore null hypothesis 5 can not be rejected.

Attitudinal Survey Section 2 Analysis

Section 2 asked the student to identify their perception of their personal level of technological sophistication, which was then compared to the final course grade. There was a significant difference of .022 noted between the final course grade and to the responses submitted for section 2. Table 5 presents a further breakdown of this analysis.

Table 5: Survey Section 2 Analysis by Overall Final Course Grade

	Sum of Squares	Df	Mean Square	F	Sig.
Contrast	19.987	3	6.662	3.517	.022
Error	87.147	46	1.894		

Analysis in this area looked at the type of delivery system, the overall final course grade, and the self-reported perception of the student's level of technological sophistication. The results identified in Table 6 did not indicate an area of significance between the type of delivery system and the overall final course grade. However, the significance value of the final course grade of .075, close to the alpha level of .05, warranted further analysis in this section of the survey.

Table 6: Survey Section 2 Analysis by Delivery Method and Final Grade

Source		Type III Sum of Squares	Df	Mean Square	F	Sig.
TYPE_OF_	Hypothesis	5.974	2	2.987	1.832	.221
	Error	13.027	7.989	1.631		
FINAL_CO	Hypothesis	16.755	3	5.585	3.436	.075
	Error	12.435	7.650	1.626		
TYPE_OF_* FINAL_CO	Hypothesis	7.859	5	1.572	.830	.535
	Error	87.147	46	1.894		

The data analysis in section 2 indicated that overall the web-based students (mean = 5.803) had a higher response to this section than lecture students (mean = 4.235) within this section of technological sophistication as seen in Table 7. It is interesting to note that telecourse students (mean = 4.516) responded closely to the lecture students response.

Table 7: Survey Section 2 Overall Response Analysis by Delivery Method

Type of Delivery	Mean	Std. Deviation
Lecture	4.235	.426
Telecourse	4.516	.296
Web-based	5.803	.510

Further examination identified in Table 8 shows a significance of .017 between student respondents. Students with a grade of "A" did not feel that they were as technically sophisticated as students who earned a grade of "B" or "D". In Table 8 the "I" column represents the primary value being compared to the other values, "J". For example, when comparing students who had a grade of "D" to all other students

with other grades ("A", "B", "C") the result, or mean difference, is the value of "I", or a grade of "D", minus "J", or the other grades.

Table 8: Survey Section 2 Analysis by Overall Final Course Grade

(I) Final Course Grade	(J) Final Course Grade	Mean Difference (I – J)	Std. Error	Sig.
D	C	.969	.637	.808
	B	.689	.674	1.000
	A	2.519	.796	.017
C	D	-.969	.637	.808
	B	-.281	.549	1.000
	A	1.549	.694	.183
B	D	-.689	.674	1.000
	C	.281	.549	1.000
	A	1.830	.728	.093
A	D	-2.519	.796	.017
	C	-1.549	.694	.183
	B	-1.830	.728	.093

Attitudinal Survey Section 3 Analysis

Section 3 of the attitudinal survey asked the student to evaluate the course in terms of mode of delivery and presentation concerns. Specific items in this section asked the student to rate the delivery of instruction on reliability, level of frustration experienced by the student and the perception of clear learning objectives and expected outcomes. The results were compared to instructional delivery system and a significant value of .710 was identified. Table 9 identifies that there was no significant difference in this section to the delivery systems.

Table 9: Survey Section 3 Analysis by Delivery

	Sum of Squares	Df	Mean Square	F	Sig.
Contrast	1.429	2	.714	.345	.710
Error	93.276	45	2.073		

The results of this section also compared the final course grade to the delivery system where a value of significance of .244 was identified. Table 10 presents a further breakdown of this analysis.

Table 10: Survey Section 3 Analysis by Overall Final Course Grade

	Sum of Squares	Df	Mean Square	F	Sig.
Contrast	8.953	3	2.984	1.440	.244
Error	93.276	45	2.073		

Table 11 presents a detailed breakdown of instructional delivery system and the final course grades. It is interesting to note that the web-based section was the only section to not have any students obtain a final course grade of "A". One other note in this section that asked students to provide their opinion regarding the delivery systems and the clarity of the objectives and learning outcomes that students who received a grade of "A" in the lecture class responded with the lowest score.

Table 11: Survey Section 3 Analysis by Delivery Method & Overall Grade

Type of Delivery	Final Course Grade	Mean	N
Lecture	D	5.9286	4
	C	4.2381	3
	B	5.0000	2
	A	3.2143	2
	Total	4.8052	11
Telecourse	D	5.1964	8
	C	4.6571	5
	B	5.2857	6
	A	4.7857	4
	Total	5.0311	23
Web-based	D	5.0000	1
	C	4.7854	15
	B	5.5714	6
	Total	5.0095	22
Total	D	5.4066	13
	C	4.6861	23
	B	5.3673	14
	A	4.2619	6
	Total	4.9782	56

Further analysis identified in Table 12 indicate that there is no significant difference noted between the type of delivery systems (value of .676), the final course grades (value of .121) and the comparison of delivery systems and course grades within this section (value of .758).

Table 12: Survey Section 3 Analysis by Delivery Method and Overall Grade

Source		Type III Sum of Squares	Df	Mean Square	F	Sig.
TYPE_OF_	Hypothesis	1.025	2	513	.408	.676
	Error	12.191	9.700	1.257		
FINAL_CO	Hypothesis	9.450	3	3.150	2.541	.121
	Error	11.272	9.092	1.240		
TYPE_OF_* FINAL_CO	Hypothesis	5.419	5	1.084	.523	.758
	Error	93.276	45	2.073		

Attitudinal Survey Section 4 Analysis

Section 4 of the attitudinal survey asked the student to identify their perception of the resources available to them ranging from library resources to student services. Specific questions included whether the student felt they had been provided the kinds of background knowledge and skill orientation to complete the course successfully. The students were also asked if they felt the printed materials contained clear and accurate information representing the course and whether they would recommend or consider taking another course using the same instructional delivery system. Table 13 identifies a significance value of .001 indicating a difference in the final course grade.

Table 13: Survey Section 4 Analysis by Delivery Method and Overall Grade

Source		Type III Sum of Squares	Df	Mean Square	F	Sig.
TYPE_OF_	Hypothesis	2.706	2	1.353	2.106	.155
	Error	10.117	15.744	.643		
FINAL_CO	Hypothesis	19.256	4	4.814	7.359	.001
	Error	10.899	16.661	.654		
TYPE_OF_* FINAL_CO	Hypothesis	2.224	5	.445	.328	.894
	Error	61.129	45	1.358		

Further analysis identified a value of significance of .008 when comparing the final course grade to the data in this section of the survey as seen in Table 14.

Table 14: Survey Section 4 Analysis by Overall Final Course Grade

	Sum of Squares	Df	Mean Square	F	Sig.
Contrast	21.156	4	5.289	3.893	.008
Error	61.129	45	1.358		

This analysis was further broken down when grades were compared. A significance of .012 and .011 was identified between students who received a grade of "F" and those who received a grade of "D" and "B" respectively. Table 15 presents the details of this analysis.

Table 15: Survey Section 4 Analysis by Overall Final Course Grade

(I) Final Course Grade	(J) Final Course Grade	Mean Difference (I – J)	Std. Error	Sig.
F	D	-3.257	.942	.012
	C	-2.244	.877	.140
	B	-3.120	.897	.011
	A	-2.604	1.051	.170
D	F	3.257	.942	.012
	C	1.013	.546	.702
	B	.137	.577	1.000
	A	.653	.795	1.000
C	F	2.244	.877	.140
	D	-1.013	.546	.702
	B	-.876	.465	.661
	A	.360	.718	1.000
B	F	3.120	.897	.011
	D	-.137	.577	1.000
	C	.876	.465	.661
	A	.516	.742	1.000
A	F	2.604	1.051	.170
	D	-.653	.795	1.000
	C	-.360	.718	1.000
	B	-.516	.742	1.000

This would indicate that students would received a "D" or a "B" felt that they had a higher level of resources for learning than students who received other grades, especially students who received an "F". It is interesting to note that when this data was examined with the delivery method identified the responses in this section supported this with the exception of the lecture method where students who received a grade of "D" or an "A" scored highest. Table 16 presents the details of this analysis.

Table 16: Survey Section 4 Analysis by Delivery Method & Final Grade

Type of Delivery	Final Course Grade	Mean	Std. Deviation	N
Lecture	D	5.3333	1.1627	4
	C	3.7778	1.5753	3
	B	4.1667	.2357	2
	A	4.3333		1
	Total	4.5333	1.2318	10
Telecourse	D	5.4375	1.2470	8
	C	4.3667	1.7095	5
	B	5.5833	.7941	6
	A	4.8750	1.1815	4
	Total	5.1449	1.2626	23
Web-based	D	5.0000		1
	C	4.5889	1.1766	15
	B	5.6111	.7429	6
	F	2.0000	.0000	2
	Total	4.6458	1.3498	24
Total	D	5.3718	1.1225	13
	C	4.4348	1.3092	23
	B	5.3929	.8539	14
	A	4.7667	1.0515	5
	F	2.0000	.0000	2
	Total	4.8275	1.2998	57

A question was asked in this section whether the student would recommend to others or consider taking another course using the same instructional delivery method. Of

the students who responded (n= 55), the students enrolled in the classroom replied positively with a rate of 70% (n= 7/10), while 83% (n=19/23) of those enrolled in a telecourse would take another using that mode and 91% (n=20/22) of those enrolled in a web-based course responded positively

Research Question 4

Will students feel that time and travel options provided by telecourse or web-based delivery systems impact and/or enhance their final grades compared to the lecture delivery method?

Null Hypothesis 6
There is no significant difference in telecourse or web-based student attitudes that time and travel options enhanced their final grade compared to lecture based student attitudes.

A series of Chi Square tests were applied to this hypothesis. Specific questions in the attitudinal survey were defined as categorical variables and then compared to the final grade in each of the instructional delivery systems. While there was one question analyzed that noted significance, described in detail below, overall there was not a significant relationship as measured by final grade identified in time and travel options available to telecourse and web-based students when compared to the lecture based student. Therefore null hypothesis 6 can not be rejected.

Students were asked to identify their reason for attending Lakeland Community College and their reason for selecting this course of instruction. Options ranged from advances in current job, new job opportunities, personal enrichment, and the opportunity to earn a degree. Of the respondents (n=38) who replied, 73.1% identified that they were attending to earn a degree followed by 11.5% (n=6) who where looking to advance in their current position. These responses are in line with other studies that identified that "73% to 75% stated that the most important reason for enrolling ... was to obtain a degree, followed by advancement." (Easterday, 1997, p. 31). There was a significance value of .835 indicating that there was no relationship between their reason for attending and the final course grade. Table 17 presents the results of this analysis.

Table 17: Reasons for Attending by Course Grade

		Value	Approx. Sig.
Nominal by	**Phi**	.313	.835
Nominal	**Cramer's V**	.181	.835
N of Valid Cases		51	

Students were asked to indicate, on average, how many hours they spent per week on campus for classes. While 39.4% spent ten hours or more per week on campus (n=22) there was a significance value of .042 when compared to the 60.6% who spent less than ten hours a week on average per week on campus (n=34) to the final grade. The conclusion would lead to compare the number of hours spent on campus with a higher course grade. Table 18 and Figure 1 present the results of this analysis.

Table 18: Hours per Week on Campus by Course Grade

		Value	Approx. Sig.
Nominal by	Phi	.734	.042
Nominal	Cramer's V	.424	.042
N of Valid Cases		55	

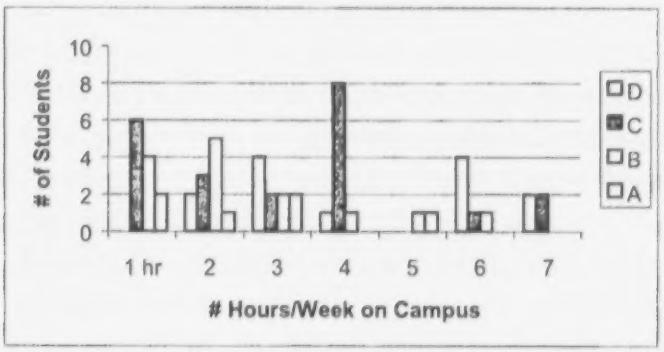


Figure 1. Hours per Week on Campus by Course Grade (A, B, C, D)

Further analysis identified a significance value of .027 when the groups were compared as seen in Table 19. However in this comparison of groups it must be noted that this significance value is questionable given the small numbers in the key sample sizes where number of the group is two, six and four.

Table 19: Hours per Week on Campus by Group Comparison

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	11.933	6	1.989	2.652	.027
Within Groups	35.944	48	.750		
Total	47.927	54			

The data reflects a wide range of responses in time spent on campus by the different instructional delivery systems. Not surprisingly, students in the lecture method

identified more hours on campus per week than students in the web-based or telecourse methods. It should be noted that the low numbers of responses, especially in the lecture method, make this a prime area for future research. Table 20 presents a detailed analysis of the responses.

Table 20: Hours per Week on Campus by Group Comparison

Type of Delivery		1	2	3	4	5	6	7	TOTAL
Lecture	Count	1	2	2	1		4	2	12
	% within Type of Delivery	8.3	16.7	16.7	8.3		33.3	16.7	100.0
	% within Hrs/wk on Campus	8.3	18.2	20.0	10.0		66.7	50.0	21.8
	% of Total	1.8	3.6	3.6	1.8		7.3	3.6	21.8
Tele-course	Count	5	7	4	3	1	2		22
	% within Type of Delivery	22.7	31.8	18.2	13.6	4.5	9.1		100.0
	% within Hrs/wk on Campus	41.7	63.6	40.0	30.0	50.0	33.3		40.0
	% of Total	9.1	12.7	7.3	5.5	1.8	3.6		40.0
Web-based	Count	6	2	4	6	1		2	21
	% within Type of Delivery	28.6	9.5	19.0	28.6	4.8		9.5	100.0
	% within Hrs/wk on Campus	50.0	18.2	40.0	60.0	50.0		50.0	38.2
	% of Total	10.9	3.6	7.3	10.9	1.8		3.6	38.2
Total	Count	12	11	10	10	2	6	4	55
	% within Type of Delivery	21.8	20.0	18.2	18.2	3.6	10.9	7.3	100.0
	% within Hrs/wk on Campus	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% of Total	21.8	20.0	18.2	18.2	3.6	10.9	7.3	100.0

The data reflects an overall mean score of 2.24, which is average of the overall final course grade. It was interesting to note that the two highest mean average scores were in the categories of students who averaged one hour per week on campus (mean = 2.67) and students who averaged five hours per week on campus (mean = 3.50). With the small sample sizes in key categories further testing with larger groups would benefit this area of analysis as Table 21 identifies the specific details and Figure 1 graphically details this analysis.

Table 21: Hours per Week Group Size Analysis

	N	Mean	Std. Deviation
1 Hour	12	2.67	.78
2	11	2.45	.93
3	10	2.20	1.23
4	10	2.00	.47
5	2	3.50	.71
6	6	1.50	.84
7	4	1.50	.58
TOTAL	55	2.24	.94

Students were asked to indicate, on average, the number of hours they worked for pay, which was then compared to the final course grade. While 51.8% of the respondents indicted that they (n=29) worked less than thirty hours a week a significance value of .541 was identified. This analysis indicates no significant difference in the number of hours worked compared to their final grade. Table 22 and Figure 2 present the results of this analysis.

Table 22: Hours at Work by Course Grade

		Value	Approx. Sig.
Nominal by	Phi	.501	.541
Nominal	Cramer's V	.289	.541
N of Valid Cases		55	

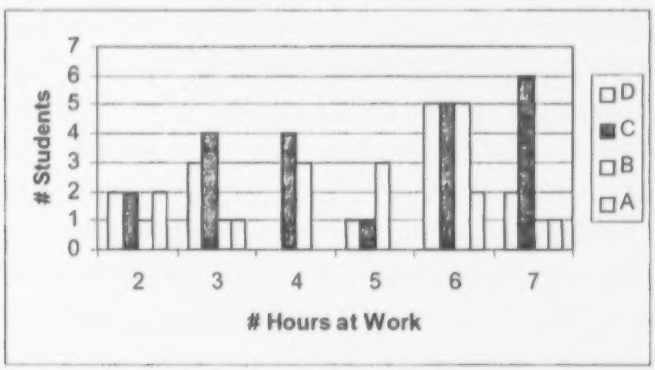


Figure 2. Hours at Work by Course Grade (A, B, C, D)

Students were asked to indicate the distance they commuted to Lakeland Community College and this response was compared to the final grade. While the significant value was .201, indicating no significant relationship, it was interesting to note that 16.1% of the respondents (n=9) reported traveling between twenty-one to fifty miles. It is of interest to note that 21% of all survey respondents enrolled in the lecture, 40% in the telecourse and 37% enrolled in the web-based class. This data would indicate that the convenience of time and travel options led students to choose either the telecourse or web-based option. Table 23 and Figure 3 present the results of this analysis.

Table 23: Distance from Campus by Course Grade

		Value	Approx. Sig.
Nominal by	**Phi**	.472	.201
Nominal	**Cramer's V**	.272	.201
N of Valid Cases		55	

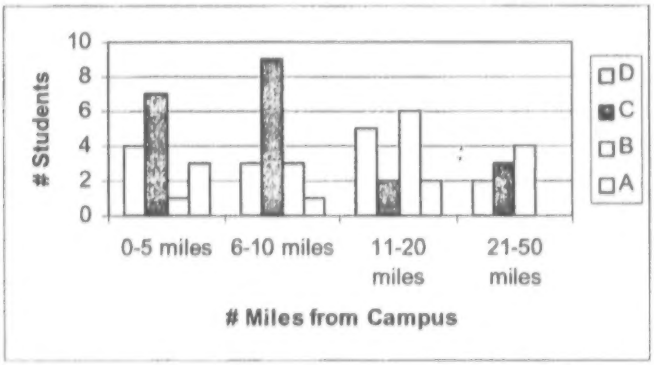


Figure 3. Distance from Campus by Course Grade (A, B, C, D)

Research Question 5

Will students feel that physical, mental, environmental, and technical obstacles within their chosen learning environment impacted and/or enhanced their learning experience in terms of performance?

Null Hypothesis 7

There is no significant difference in student attitudes that physical, mental, environmental, and technical obstacles enhanced their learning experience in terms of their final grade.

The t test was applied to this hypothesis. "The t test makes adjustments for the fact that the distribution of scores for small samples becomes increasingly different from a

normal distribution as sample sizes become increasingly smaller." (Gay, 1992, p.436). Students were asked if they had a learning disability or were physically challenged (n=2) and their responses to survey sections 2 and 4 were included in this analysis. The results were then correlated to the final grades in each of the instructional delivery systems. Table 24 presents the results of this analysis. It should be noted that this analysis carries questionable significance due to the small sample size in this category.

Table 24: Analysis of Attitudes Impacted by Learning Disability

	Disabled	N	Mean	Std. Deviation
Average on Sect. 2	**No**	55	4.8909	1.4408
	Yes	2	4.5000	1.7678
Average on Sect. 4	**No**	53	4.9843	1.1544
	Yes	2	3.5000	2.1213

It was interesting to note that the two students who identified themselves as disabled chose different delivery systems. One traditional age female chose the lecture method while the other was a non-traditional age male who chose the web-based course. The female did not specify the learning disability; however, the male claimed Attention Deficit Disorder. The use of the web-based system could be proposed as a logical solution for a student with a learning disability by providing an instructional experience that is individualized and provides the advantages computer-based technology systems offer including interactivity, immediate feedback, and drill-and-practice capabilities (Newby, Stepich, Lehman & Russell, 1996).

Section 2 and section 4 were also analyzed using a series of t tests to test for attitudes that could impact the final course grade due to possible obstacles. Section 2 involved technological sophistication and contained queries about technical skills and section 4 contained queries regarding resources for learning. Combined, these areas indicate factors that might impact a student from successfully completing the course. Final course grades were compared to these sections and no significant difference was noted. Therefore, null hypothesis 7 can not be rejected. Table 25 presents the results of this analysis.

Table 25: Comparison of Attitudes between Disabled and Non-disabled Students

	t test for Equality of Means		
	t	df	Significance
Average on Sect. 2			
Equal variances assumed	.375	55	.709
Average on Sect. 4			
Equal variances assumed	1.746	53	.087

Summary

A complete analysis of the attitudinal survey is contained in Appendix E. One interesting data area centered on the rate of student completion. As noted in Chapter 2, traditional lecture classes have a lower dropout rate compared to courses offered in other formats such as telecourses and web-based courses. This research and the analysis conducted here support this trend. However, caution must be noted in the analysis of this data given that the traditional lecture course was not offered in the Winter quarter of the academic year 1999 - 2000 when this study was conducted. The interim Director of Research at Lakeland Community College, Sharon Blankenship,

indicated that the dropout rates noted in the telecourse and web-based course offerings were not considered out of the normal range for any of the tested delivery systems at this institution (Personal communication, September 22, 2000). The dropout rates identified in this study were far below those mentioned in prior research where dropout rates ranged from 40% (Adams, 1987) to 30% (Bink, et. Al., 1995) to 32% (Institute for Higher Education Policy, 1999). Table 26 presents the results of this analysis.

Table 26: Dropout Rates

	Enrolled	Withdrew	Completed	Drop Rate
Telecourse	92	11	81	12%
Web-based	46	7	39	15%
Lecture	38	3	35	8%

In summary, the results indicate that overall there is no significant difference between lecture, telecourse and web-based delivery systems in terms of the final course grade and the attitude towards the instructional delivery system. No significant differences were identified in terms of gender or age when compared to the final course grade.

Chapter 5

Conclusions, Implications, Recommendations, and Summary

Introduction

There continues to be a tremendous growth in distance learning programs offered by colleges and universities. This affords the growing cohort of adult learners' access to educational opportunities. The National Center for Educational Statistics reported "that in December 1999, 44% of higher educational institutions in the U.S. offered distance education courses." (Short, 2000, p. 56). While telecourses have provided a reliable source of instruction to date, the growth in web-based course offerings has seen an amazing "38% increase from 1995 to 1999 in the number of institutions using computer technology to deliver courses to students" (Short, 2000, p. 56).

The goal of this research was to compare and evaluate three different instructional delivery systems in terms of student performance, using a pre-test and the overall final course grades, and attitude towards the delivery system. The purpose was to determine if there were measurable differences in outcomes between students taught in a classroom-based lecture course, the video-based telecourse, and an online, web-based course. This research compared traditional student achievement to non-traditional student achievement to determine if any differences could be attributed to age as well as gender as it related to the instructional delivery system. Student

satisfaction, as measured by attitude towards the chosen instructional delivery system, was compared to the overall final course grade to determine if individual satisfaction equated to successful performance.

One benefit of this study includes providing data to institutions that seek to create a "more complete metric of exactly how the traditional institution should position itself" (Downes, 2000, p. 4) in terms of distance learning offerings. Further research is still being identified as vital in providing additional evidence of the learning effectiveness. Several recommendations have been suggested by the Center for Academic Transformation and include external factors such as employers and graduate schools that can provide feedback regarding student success. Specific recommendations have suggested that institutions should collect and analyze internal data such as "completion rates, grade distribution, class size" (Twigg, 2001, p. 22) as well as delivery times and other longitudinal studies.

Data from this study may be able to benefit other institutions that are currently examining how to expand distance education courses by investing in technology solutions. These institutions face increased competition in today's market from private sector companies offering education and from for-profit institutions. The opportunity for an institution to reach student markets long denied due to geographic and time constraints is expanding daily with institutions striving to provide increased access to education using innovative methods and technology-based systems. In a report to the Ohio Learning Network, Michael Governanti, of Miami University

Middletown, stated that the technology option and "opportunities stand out in our region and state where participation rates in higher education are below national averages. A major question for our campus will be: how to best avail ourselves of these opportunities to serve this potential market." (Personal communications, July 28, 2000).

This study focused on the differences between students in a traditional classroom setting and students taking a telecourse or a web-based course at times and locations of their choosing. This study also compared traditional age students to non-traditional age as well as gender to see if there were any differences that may be linked to these attributes as well as to the instructional delivery system used.

Instruction requires assessment to ensure effectiveness for the student. Technology-based delivery systems must be constantly evaluated in order to determine that the strengths and weaknesses of the technology do not impact the students' results. If the delivery system negatively impacts student outcomes, the instructional delivery systems use should be reconsidered. This study examined the effectiveness of using a telecourse and a web-based course to teach an Introduction to Statistics course at Lakeland Community College with a classroom equivalent. This study used the students who enrolled in the Math 155, Introduction to Statistics, course during the academic year 1999 - 2000 at Lakeland Community College and who completed the pre-test and final exam. Since it was the only content topic in this research, generalizations to other subject areas may be limited, even in similar conditions.

Table 27 presents the analysis of the sample participation by delivery system and gender.

Table 27: Sample Data Figures

	TELECOURSE		WEB-BASED		LECTURE		
	A	**B**	**A**	**B**	**A**	**B**	**TOTALS**
Fall	**1**	**2**	**2**	**6**	**11**	**6**	**28**
	1F / 0M	0F / 2M	1F / 1M	3F / 3M	6F / 5M	4F / 2M	15F / 13M
Winter	**0**	**14**	**1**	**8**	**0**	**0**	**23**
		11F / 3M	1F / 0M	4F / 4M			16F / 7M
Spring	**0**	**7**	**2**	**8**	**4**	**6**	**27**
		5F / 2M	0F / 2M	7F / 1M	3F / 1M	2F / 4M	17F / 10M
TOTAL	**1**	**23**	**5**	**22**	**15**	**12**	**78**
	1F / 0M	16F / 7M	2F / 3M	14F / 8M	9F / 6M	6F / 6M	48F / 30M

Legend: **A** = 21 with pre-test and final grade. **B** = 57 with pre-test, final grade and survey (73% of total number, n=78). **F** = female, **M** = male.

Of the students who completed the two tests 31, or 40%, were in the traditional age bracket (under the age of 22), and 47, or 60%, were in the non-traditional age bracket (22 and older). This age factor was different than other distance learning demographic research that had indicated that "the independent study population has shifted towards younger students" (Wallace, 1996, p. 1). It is interesting to note that in this sample group women were the larger of both age groups respectively as Table 28 illustrates. This data reflects similar results obtained in other studies (Wallace, 1996; Easterday, 1997).

Table 28: Sample Data by Gender & Age

	Age Groups	Number	Total	Total	Percentages	Total
Male	Traditional	13			17%	
	Non-traditional	19			24%	
Total by Male			32			41%
Female	Traditional	18			23%	
	Non-traditional	28			36%	
Total by Female			46			59%
Total by Traditional				31		40%
Total by Non-traditional				47		60%
Totals			78	78		100%

Of this sample group of 78 students, 57 or 73% also completed an attitudinal survey. It is interesting to note that the online and telecourse students responded to the request to complete the attitudinal survey even though the survey was administered in a text format at the time of the final exam. It could be suggested that a reason for the higher response rate from the two distance student groups is related to their field independent style of learning that typically has a higher level of intrinsic value associated to the learning process (Shih & Gamon, 1999). Of the 27% who did not complete the survey, the lecture students were significantly higher in their lack of participation. Tables 29 and 30 illustrate the participation by delivery method.

Table 29: Survery Respondants by Delivery Method

Delivery Method	# Respondents	% of Total (n =78)
Lecture	12	15%
Online	22	28%
Telecourse	23	30%
Totals	**57**	**73%**

Table 30: Survey Non-Respondants by Delivery Method

Delivery Method	# Respondents	% of Total (n = 78)
Lecture	15	19%
Online	5	7%
Telecourse	1	1%
Totals	**21**	**27%**

Conclusions

Five research questions and six null hypotheses were tested in this study. The questions are listed and addressed in order below.

Research Question 1

Will there be a significant difference in student achievement as measured by overall final course grade related to the instructional delivery method?

Null Hypothesis 1

There is no significant difference in student achievement as measured by overall final course grade between telecourse, web-based or lecture-based delivery method.

Null hypothesis 1 was tested using an analysis of variance, ANOVA. The ANOVA had a dependent variable of the final course grade and the results indicated no significant difference in the final course grade comparison between the instructional delivery methods composed of classroom delivery, telecourse and web-based delivery systems. "Adults prefer to learn in a variety of ways, and there is no one "correct" method of learning." (Driscoll, 1998, p. 14). This research indicates that there is also no harm to the learner, as measured in final course grade, by institutions using

alternative instructional delivery systems. The feedback obtained in the attitudinal survey suggests that alternative delivery systems such as telecourses and web-based instruction may work to the student's advantage in terms of time and access gained. Technology offers the student the ability to shift time and increase access to instructional materials compared to traditional lecture-based delivery.

Research Question 2

Is student achievement, as measured by final grade, impacted by the age and gender, of the traditional student compared to the age and gender of the non-traditional student regardless of delivery method?

Null Hypothesis 2
There is no significant difference in student achievement, as measured by final grade, between traditional (under the age of 22) and non-traditional age (22 and older) student between telecourse, web-based or lecture delivery method.

Null Hypothesis 3
There is no significant difference in student achievement, as measured by final grade and gender, between telecourse, web-based or lecture delivery method.

Null Hypothesis 4
There is no significant difference in student achievement, as measured by final grade and gender, between traditional and non-traditional student between telecourse, web-based or lecture delivery method.

Null hypotheses two and three were tested using a factorial design based on a 3 x 2 x 2 analysis of covariance (ANCOVA) with one covariate. Using the ANCOVA analysis the method of delivery was the independent variable while age or gender was used as a classifying independent variable for the respective hypothesis. The final course grade was the dependent variable used in this ANCOVA analysis. The pre-test was used as a covariate in this research study to control for any preexisting differences among the groups.

There was no significant difference in the interaction of the delivery methods with the pre-test used as a covariate on the final course grade with traditional and non-traditional age students. The results of the ANCOVA analysis showed no significant difference among the three instructional delivery methods on the overall final course grade (dependent variable) when comparing traditional age students to non-traditional age students. The results also indicated no significant statistical difference in student achievement with regard to gender. Therefore, it can be concluded that for this research project there is no significant statistical difference in student achievement, as measured by overall final course grade, using the three different instructional delivery systems when comparing traditional and non-traditional age students regardless of gender.

It was interesting to observe that, overall women of all ages had higher final course grades in the different sections and delivery systems. The one exception was in web-based where non-traditional men had a higher final course grade. This result was

different than other studies that had identified women as being more successful (Institute for Higher Education, 1999). One possible explanation for this difference could be that distance learners are typically more field-independent in their learning style (Miller, 1997). Field-independent learners, such as the non-traditional age males noted above, "tend to approach a problem more analytically, rely on self-structured situations, prefer competition, and are intrinsically motivated." (Shih & Gamon, 1999, p. 2). Another study conducted by the U.S. Navy supports the research indicating that "females are more likely to be field-dependent learners" (Golas, Bartoli, Miller, & Idar, 1999, p. 8). This Navy study also discovered that males had scored slightly higher than females on a final exam but not statistically different. Other studies had also identified traditional age students having a higher level of technological knowledge which was related to higher grades compared to students who have not had as much web and computer experience (Broad, 1999). This research indicated otherwise which is encouraging for community colleges that are looking at offering web-based courses and whose typical student is a non-traditional age student.

Research Question 3

Does student satisfaction, as measured by attitudes towards the chosen delivery method, impact the final grade?

Null Hypothesis 5

There is no significant difference in student achievement, as measured by attitudes, between telecourse, web-based or lecture delivery method.

A series of ANOVA analyses were prepared to test this hypothesis. ANOVA was used because of the averaging of the sections contained in the attitudinal survey. Specifically, particular sections in the survey were averaged and then compared to the student's final grade. The student was unaware of their final grade at the time the survey was being filled out. Overall the combined sections indicated that there was no significant statistical difference in student achievement as measured by attitudes between the instructional delivery systems.

Section 2 asked the students to identify their perception of their level of technological sophistication, which was then compared to the final course grade. In this analysis, there was a significant difference with a value of .022 in student achievement as measured by this section's response in terms of delivery system and final course grade. Not surprisingly, responses in this section regarding personal level of technology were higher from web-based students (Mean = 5.803) compared to lecture-based students (Mean = 4.235). One area of interest in this section involved the perception of skills when compared to the final grade. Students who earned an "A" did not think they were as technically savvy as students who earned a "B" or a "D". Students who earned a "D" scored themselves the highest in this section concerned with perception about technology skill. These students had a mean difference between themselves and students who earned an "A" of 2.519. It could be

suggested that "A" students feel they must work harder and therefore are not as confident of their individual technical skills.

Section 3 in the attitudinal survey asked the students to evaluate the course in terms of mode of delivery and presentation concerns. This was then compared to the final course grade. Further analysis identified no significant difference noted between the type of delivery systems (significance value of .676), the final course grade (significance value of .121) and the comparison of delivery systems and course grade within this section (significance value of .758). It was interesting to note this result, since other studies (Brey & Grigsby, 1984; McNabb, 1994) had indicated the telecourse mode of delivery would see favorable responses to questions ranging from reliability, clear objectives, and expected outcomes. The results could indicate that the web-based section, when written clearly, has the same favorable perception to a student as telecourses have had in the past.

Section 4 asked the students to identify their perception of the resources available to them ranging from library resources to student services. There was a significant difference of .001 in the overall final course grade noted in this ANOVA analysis illustrated in Table 13. It is interesting to note that students with final course grade of "F" felt that they had a greater access to resources than students with a final course grade of "D" or those with a "B". Further investigation would be indicated here to obtain detailed reasons for this response. This section also identified that the traditional classroom student felt very strongly that they had more availability to

resources for learning with a mean difference of -.663 compared to telecourse students but only .103 compared to web-based students as seen in Table 31.

Table 31: Survey Section 4 Comparison Analysis by Delivery Method

Type of Delivery (I)	Type of Delivery (J)	Mean Difference (I-J)	Std. Error	Sig.
Lecture	Telecourse	-.663	.490	.548
	Web-based	.103	.569	1.000
Telecourse	Lecture	.663	.490	.548
	Web-based	.766	.458	.305
Web-based	Lecture	-.103	.569	1.000
	Telecourse	-.766	.458	.305

Included in this section was the question whether a student would recommend or consider taking another course using the same type of instructional delivery system. Of the students who responded the overall result was 84% (n=46) who responded favorably. Specific responses from all three instructional delivery systems included students enrolled in the lecture sections 70% (n=7/10) of whom answered favorably, 83% (n=19/23) of the telecourse students responded favorably and 91% (n=20/22) of the web-based students answering favorably. The lack of social integration might have been a factor for a less than favorable response as suggested by Pugliese (1994); however, with the responses obtained in this research it, can be surmised that the options of time, travel, and self-paced learning suggested by Ridley, Bailey, et.al (1997) and Wallace (1996) among others were viewed very positively by the students.

Research Question 4

Will students feel that time and travel options provided by telecourse or web-based delivery systems impact and/or enhance their final grades compared to the lecture delivery method?

Null Hypothesis 6
There is no significant difference in telecourse or web-based student attitudes that time and travel options enhanced their final grade compared to lecture based student attitudes.

A series of Chi Square tests were conducted to formulate crosstab summaries for the questions used in determining the input for this question. Overall, this analysis indicated no significant relationship between the final grades and the time and travel options offered to students at a distance compared to lecture based students. Detailed analysis determined that there was no significant relationship between the final course grade and a specific reason for taking this college course via a specific instructional delivery system.

There was a significance value of .042 between the hours spent on campus and the final grade indicating a significant difference as seen in Table 18. While the data might suggest that the more hours spent on campus will lead to a higher grade, this number is questionable, however due to the small sample sizes in the groups. In the groups who spent five, six and seven hours a week on campus the sample size groups were only two, six and four respectively. This is an area that should be further

researched to confirm significance. However, the significant value for the test between the hours spent at work per week and the final grade was a .541 indicating no relationship. It was interesting to note that approximately 18% of the respondents indicated that they worked 40 or more hours a week. Further, 30% indicated that they worked between 31 and 40 hours a week with the remainder, 52%, worked under 30 hours a week. This is in line with other studies that indicate that the community college student works part-time (Smith, 1993; Roberts, 1996; Langenberg, 1999). This part-time student cohort data would support institutional efforts to provide additional instructional programs that allow the ability to shift time by providing increased flexibility of schedule over lecture systems such as telecourse and web-based.

Likewise, a significance value of .201 was measured indicating no significant relationship between the distance a student had to travel to campus and their final grade. While the sample was small it is interesting to note that approximately 26% lived within five miles from campus, 57% lived between six and 20 miles and 16% lived between 21 and 50 miles away. This result follows other studies where students choosing non-lecture options were within the traditional service area of the host institution (Ridley, et.al., 1997). It is also of interest that of the students who responded to the survey (n=57), 21% were enrolled in the lecture, 40% enrolled in the telecourse and 37% enrolled in the web-based section. Enrollment in the traditional lecture sections did not appear to be impacted with a drop in enrollment according to Sharon Blankenship, interim Director of Research, at Lakeland Community College

(Personal communication, September 22, 2000). It would appear that offering other methods of instructional delivery supported other research that suggested enrollment gains as opposed to enrollment redistribution (Ridley, et. al., 1997).

Research Question 5

Will students feel that physical, mental, environmental, and technical obstacles within their chosen learning environment impacted and/or enhanced their learning experience in terms of performance?

Null Hypothesis 7
There is no significant difference in student attitudes that physical, mental, environmental, and technical obstacles enhanced their learning experience in terms of their final grade.

A t test was conducted to analyze this null hypothesis incorporating sections 2 and 4 from the questionnaire. Of the 57 students who completed the survey only two indicated that they had a disability. This low sample size (n=2) has a questionable value although it is interesting to note that each student chose a different delivery system. The traditional age female chose the lecture method while the non-traditional age male chose the web-based course. The use of the web-based delivery system could be proposed as a logical solution for a student with a learning disability by providing an instructional experience that is individualized and provides the advantages computer-based technology systems have (Newby, Stepich, Lehman &

Russell, 1996). The potential advantages technology may bring to a student must be evaluated carefully against the social learning need a student may require (Ormrod, 1990).

Sections 2 and 4 of the survey were analyzed to identify obstacles and attitudes that may impact the final course grade and the groups were combined and compared. There was a value of significance of .709 identified in section 2 that queried students about their perception regarding their level of technological sophistication as well as queries about technical skill levels. Section 4 asked students about their perceptions regarding the resources available to them during this learning process and a value of significance of .087 was identified. These kinds of responses are in line with other studies that identified flexibility and their belief that they have the same access to the same learning opportunities as lecture-based students (Easterday, 1997).

Final Conclusion

Overall, the conclusion that can be drawn from the results identified above indicate that there is no significant statistical difference, as measured by the final grade, between the classroom, telecourse and web-based instructional delivery systems used in this research project. In summary the key points include:

- Students did as well in the course of instruction regardless of delivery system.
- The age and the gender of the student did not impact the final grade regardless of delivery system.

- Student satisfaction, or lack of, does not impact the final grade regardless of the delivery system.
- Time and travel options do not impact the final grade regardless of the delivery system.
- Obstacles including physical, mental, environmental and technical concerns do not impact the learning experience in terms of their final grade regardless of the delivery system.

Implications

This research is taking place at a community college that has met the needs of the traditional as well as non-traditional student using classical, classroom-based, teaching methods. As the older student cohort begins to impact student enrollment (Langenberg, 1999), these institutions are facing challenges in meeting the needs of these students in terms of facilities and faculty resources. Learning increases when "there is more interaction and faster feedback between students and their professors, between parents and their children; students (and siblings) help each other learn (collaborative learning), students are provided the same material in multiple formats." (Brown, 2000, p. 22). Institutions have identified distance education as an alternative means of access to instruction and are working to create programs that meet the needs of this non-traditional student. "The learning process must incorporate practical application of the subject matter and be problem-centered. Finally, facilitation, as opposed to the lecture approach, is much more likely to be successful for the older student." (Ellis, 2000, p. 14). The data collected from this study can be used by other

institutions facing the challenge of delivering instruction to a community of distance learners.

"Distance education represents the convergence of a host of issues for higher education." (Oblinger & Kidwell, 2000, p. 31). This study will contribute to the field of distance education in terms of the issues institutions face as they alter their traditional approach to delivering instruction in order to reach new markets and compete against new educational providers. There is a tendency to define distance education as a technology issue and in terms of hardware costs it needs to be evaluated as such. This study brings additional data on the impact and effectiveness that two technology-based delivery systems have on student success. The results can be reviewed and analyzed against the benchmark of lecture-based instruction in order to obtain and implement the most effective delivery system for a student-centered institution.

The specific analysis of two of the most frequently used instructional technology-based delivery systems (Boettcher, 2000), the telecourse and the web-based course, compared to the lecture-based class will assist institutions in determining how to invest faculty development time and staff production time in the creation of instruction. This study offers insight on how the technology-based systems studied can impact students and, with analysis of the data obtained, provides a contribution to pedagogical techniques that can be used allowing institutions to control "costs while simultaneously creating more-effective learning experiences for students." (Twigg, 2000b, p. 49).

Very little research currently exists that brings these three delivery systems together under the parameters conducted by this study, yet community colleges and universities are seeking this type of data as identified by the University of Illinois Faculty Forum. They stated that "we think a rigorous comparison on learning competence with traditional classrooms can and should be done." (University of Illinois, 1999, p. 51). This research provides additional opportunities for institutions to compare, analyze, and conduct their own studies that will add to the body of knowledge within the distance learning community.

The results of this research indicate several differences in the successful student, specifically supporting past studies that indicate the successful distance student is a non-traditional age female living within sixty miles of the institution and working part-time. This research also showed that non-traditional males were successful using web-based instruction and computer technology. These differences impact how distance courses are designed and marketed. This data impacts how an institution targets students and how it creates a strategic recruiting plan to increase enrollment. Expanding services that support working students could impact enrollment positively. For example, offering library and bookstore alternative time and location options to access these resources away from campus, and even on-campus, might reduce barriers to the student. An additional example, specific to the non-traditional parent, who works part-time, might be childcare provided on campus. Targeted career counseling options offered remotely might include job search and interviewing skills.

Data collected from the attitudinal survey offered insight into new access considerations. Several written responses indicated that students wanted additional training on using web-based tools, especially library and on-line reference tools, in order to access the instruction. This response may result in a unique course offered on the host campus or specially designed for web-based browser access.

Recommendations for Future Research

One recommendation for additional research would be to increase the population size by comparing instructional delivery systems at institutions that have larger class sizes. Other studies may want to evaluate the teaching and learning process as determined by class size. A recent University of Illinois study indicated a concern that the number of students being taught online "at the same level of quality as in the classroom requires more time, or equivalently, in the same amount of time fewer students can be taught online than in the classroom if high quality teaching is to occur." (University of Illinois, 1999, p. 49). An expansion on this recommendation would be to conduct research that focused on and compared the effectiveness of an entire academic program that was delivered traditionally and at a distance.

In addition to expanding the population size, a further recommendation would be to analyze the student age in greater detail. For the purposes of this study, 22 years old was the line defining traditional and non-traditional age students. Recent research by de los Santos Jr. identified that the community college population included students

in age groups that contained "60 percent were older than 22 years of age; 15 percent were 40 years old or older" (2001, p. 28). A recommendation for future research would suggest expanding the age separation to include traditional and several mid-range age groups in order to explore this older student cohort in greater detail.

A limitation encountered centered on the method of calculating the overall final course grade with the lecture class using a comprehensive final exam and the telecourse and web-based course used a non-comprehensive final exam as noted in Table 32 below.

Table 32: Overall Course Grade Collection

	Lecture	Telecourse	Web-based
Labs	X	X	X
Quizzes/Tests	X	X	X
Final: *Comprehensive*	X		
Final: *Non-Comprehensive*		X	X

After the data analysis was completed, this limitation was further explored to determine if the calculation of the dependent measure, the overall final grade, might have been impacted by the varied collection of data used in determining the overall final grade.

The researcher explored for differences within the telecourse female student group comparing traditional and non-traditional age groups and within the web-based male student group comparing traditional and non-traditional age groups. These sections, identified in Table 4, were chosen because they had the largest mean differences in

the overall final grade. A t-test was utilized and this additional analysis gave no evidence of significant difference in the mean results. It was noted that both of the tested delivery systems utilized the same calculation method in determining the overall final grade. Based on personal communications with Dr. Craig Mertler, Assistant Professor in Research Methods, Measurement, & Statistics at Bowling Green State University, the use of the overall final grade as a comparison is a commonly accepted practice within the field of education as calculations are made and grades compared even when students do not take the same course (Personal communication, April 30, 2001). As a recommendation for further research, efforts should be made to ensure that the collection of data used in determining the dependent variable are as similar as possible.

Another new research study could focus on how instructional tools and design methodologies can be used to create a learning environment that maximizes student interaction. Jules LaPidus, head of the Council for Graduate Schools, stated, in a speech given at Claremeont Graduate University, that discussion regarding "the uses of information technology in teaching and learning appears to be focused on its use as a delivery system for content rather than on how it will alter and improve the ability of people to learn" (as cited by Munitz, 2000, p. 15). Communication tools and interactive collaboration exercises have been touted as a part of the emerging technology benefits, but there is little data to support whether these tools help or hinder the learning ability of the distance student.

The results identified in the data will benefit institutions by supporting their efforts to provide self-assessment exercises and learning style inventory testing in order to increase student persistence (Fjortoft, 1996) and to prepare students for successful distance learning experiences. This research could have been enhanced and made more meaningful if options such as the learning inventory were administered to the student population. While there continues to be discussion regarding whether or not the use of technology to deliver instruction is effective, this research stresses the need to focus further studies on the altering, or transformative, power delivery systems may bring to people to access new instructional opportunities. This type of research would further increase the ability to improve the learning experience rather than just realize efficiencies contained in the process and would benefit institutions that strive for a "high level of consistency in course development, design and delivery." (Twigg, 2001, p. 22).

During the course of this research, there were many opportunities to exchange ideas with colleagues within the academic community and several topics for additional research were identified and listed below:

- How does time spent on campus and grades compare to time spent online and the grade?
- How much interaction and response time between instructor and student is needed to impact dropout rates among distance students?
- What is the dropout rates for an entire institution, comparing classroom to distance offerings?

- One volatile area involves research into instructor skills and how they are teaching distance students. Different delivery systems often require different presentation and communication skills in order to be effective as noted in videoconferencing systems (Brown, 1988) and web-based systems (University of Illinois, 1999). Research into presentation and communication styles is warranted and should be combined with the relation of the response time between faculty and student interaction to ensure effective student learning occurs.

An outcome of this research has caused the host institution to investigate its institutional policies regarding the development and process of delivery of distance learning courses. Specific questions were identified during the course of this project that include the level of staff support and instructional design input during the development cycle and where the line is between academic freedom and effective delivery of instruction in different media-based formats.

Another outcome of this research has resulted in the host institution tracking all courses offered in multiple delivery formats and tracking dropout rates as well as final course grade. Tracking formal withdrawal forms is prompting individual phone calls to the student to identify problems that may be related to the delivery system or support services offered by the institution. This project has been formalized so that trends may be identified resulting in new services, improved delivery methods and other instructional options directed at improving student success.

Summary

"Distance education represents the convergence of a host of issues for higher education."(Oblinger & Kidwell, 2000, p. 31). The academic institution has delivered instruction to students at a distance for hundreds of years beginning with print-based correspondence courses to video-based telecourses and now to the rapidly evolving Internet and web-based courses. One question raised by faculty, students and administrators centers around the quality of education delivered in web-based courses. The National Education Association president, Bob Chase, stated that the "public debate over the merits of Internet-based distance learning has too often consisted of high-pitched vitriol and hyperbole." (National Education Association, 2000, p. 1). This research provides additional data to the educational community to show that student performance was not impacted by their choice of a telecourse or a web-based section. Grades were not significantly different either when compared to grades earned by students in the traditional lecture class.

The goal of this research has been to ultimately make a difference to the student learners. Academic institutions will have additional data to aid in making informed decisions and creating learning environments that will increase access to instruction so that the process of life-long learning will grow successfully. Of specific interest to many is how the use of the Internet and a web-based course would be compared to other, more traditional course delivery systems. It has been said that the delivery of education, or "e-learning" via the web will be the leading growth application, "the

combined public and higher education e-learning market will explode and could easily equal or surpass the corporate e-learning market." (Rosenberg, 2001, p. 309).

One practical application of the data will be to allow faculty and administrators to review and evaluate future investments in technology with consideration for quality instructional offerings and cost effective implementation of technology systems. Additionally, the investment in support staff and faculty training can be analyzed with an increased focus on choosing specific tools to meet the growing demand for courses offered at a distance. Investment decisions in technology can be aided by the results of this research.

Institutions with an active telecourse program can see from the data collected that student success and attitudes are still current and not significantly different from their classroom counterparts. The data from this research indicates that issues, such as flexibility of schedule and reduced travel, that motivated students in the past to choose this delivery system (Easterday, 1997) are still valid today. Expanding services to students, such as making tape sets available or adding another communication tool, such as a web-based component to the telecourse, may enhance the learning experience (Hammond, 1997).

The same can be said for web-based students as well. Of particular interest is that "communication between faculty and students is more frequent and timely, more collaboration occurs among students, students have access to a broader range of

materials and people, computers enable more interaction, collaboration, and customization, and consequently, better learning." (Brown, 2000, p. 22). With the rapid growth of the web, this delivery option may be an attractive choice to an institution that is looking at expanding its course and program offerings.

An outcome of this research is the exploration of the changing role of the instructor at the host institution. Literature review and conversations with the faculty identified that delivering instruction via telecourse or web-based involved adding new activities for interaction with the student. Faculty involved in this research identified the need for an increased focus on the student. Specific topics related to communication issues were identified as worthy of further exploration. The instructor who chooses to create and deliver instruction using a technology-based system must become the designer "of the learning environment, constantly assessing and seeking improvements. They will continue to guide, mentor and evaluate the learning of their students." (Boggs, 1999, p. 3). This research identified that the delivery systems do not significantly impact learning; however, research has identified that interactivity, communication and timeliness are vital in successful student completion of distance courses (Biner & Dean, 1995; Bink,et. al., 1995).

The conclusion that can be drawn from the results identified from this study indicate that there is no significant statistical difference, as measured by the final grade, between the classroom, telecourse and web-based instructional delivery systems. Other research (Institute for Higher Education Policy, 2000) is suggesting that the

design of the instruction, and not the delivery system, should be more closely examined especially web-based programs that need to tightly integrate content and the development of instructional materials. Technology-based delivery systems may offer the same opportunities to focus on skills that are based on defined learning outcomes; however, the need of the student's learning style should be considered and this may lead to blended course offerings integrating mixed instructional delivery systems. This can be accomplished by utilizing the technology-based tools to increase the student's "ability to gain access to information, to interpret it, to give it context, to use information to solve problems, and to collaborate with others in problem-solving." (Doucette, 1994, p. 23). While technology-based solutions bring new sources of information to the learning experience, the classroom still provides unique, interactive solutions to learning. The classroom needs to change to integrate technology options and information access to students involved in "group interactions, business problem solving, performance evaluation, expert observation, culture building, and teamwork" (Rosenberg, 2001, p. 120) experiences that are vital components of the learning experience. It may be said "what is emerging most clearly from the technological explosion is, ironically enough, a refocusing on people." (Winer, Rushby & Vazquez-Abad, 1999, p. 891).

The data from this research supports this increased attention on the student and on the design considerations of content that will utilize technology-based delivery systems such as telecourses and web-based courses. Since the instructional delivery systems do not impact the learner then institutions can focus on continued evaluation and

assessment of the options technology-based systems bring to the learning experience in terms of access to instruction, time and distance flexibility, and increased communication between student and instructor. "It is imperative to begin building and implementing models of change that will be comprehensive, systematic, and successful in order to prepare students for the world of tomorrow." (Robinson, 2000, p. 65).

Appendixes

Appendix A

Pre-script for Comparison of Student Performance and Attitude in a Lecture Class to Student Performance and Attitude in a Telecourse and a Web-based Class

Welcome to Math 155, Introduction to Statistics. This class is taught in three different ways: lecture, telecourse and web-based. A member of Lakeland's management team, Bill Ryan, is working on his doctorate program and as a student he is asking for your assistance. Your involvement is strictly voluntary and your participation does not impact or affect your grade in any way. There are two things involved in this research study, a written pre-test that you would take now and should take approximately fifteen (15) minutes. Finally, at the end of the term, there is also a written survey that asks twenty-six (26) multiple choice questions about your opinion regarding the method of delivery used. This should take approximately twenty (20) minutes of your time. There are also places to write in your ideas, comments and suggestions.

You will notice that this pre-test has a place for you to write in your name. Your names are needed to correlate the three data collection tools. During this time the data with your name on it will be collected and delivered to Bill Ryan for grading and for security. I will not see the grades and your name, individual grade and opinion will not be used in his dissertation. I will provide anyone with his office, phone number and email address if you want. He expects to finish and graduate in

December 2000 and copies of his dissertation will be available in the Lakeland Community College Library.

This research project is looking at how different delivery systems impact the college and how each of you is impacted as well. Your identity and confidentiality will be maintained and your participation is strictly voluntary. Do you have any questions?

(The faculty member will write down any questions that need to be addressed by the researcher. The researcher will follow-up with a response to the student.)

Appendix B

Statistics PreTest

Name:_____

Type of Course (circle): Telecourse **Web-based Course** **Lecture Course**

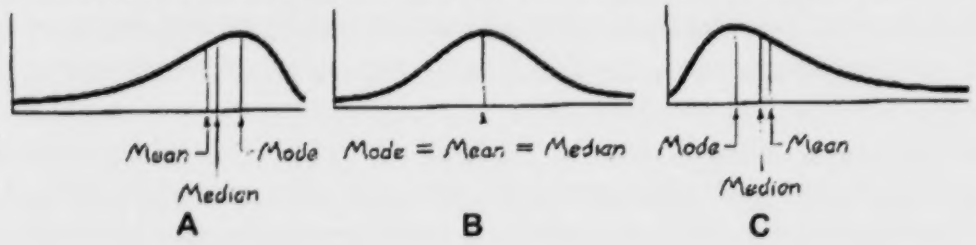
1. Data collected on a person's eye color is an example of *interval* level data.

Answer (circle): True False

2. A numerical measure associated with a sample is called a *parameter.*

Answer (circle): True False

3. Which graph shows that the data is *skewed left* (or *skewed negative*)?



Answer (circle): A B C

4. Determine the *sample mean* of the ages of the following college graduates.

Data: 27, 24, 23, 25, 25, 29, 22, 26, 22, 21, 21, 30

Answer:_____ (Round your answer to one decimal place.)

5. Determine the *population standard deviation* of the data in item 4.

Answer:_____ (Round your answer to one decimal place.)

6. Two cards are randomly selected from a standard deck without replacement. Find the probability of selecting a *King* then selecting a *Queen.*

Answer:_____ (Round your answer to one decimal place.)

7. Let **A** = event that a female is randomly selected and **B** = event that a worker with a college degree is randomly selected. Are events **A** and **B** *mutually exclusive*?

Answer (circle): Yes No

8. A certain medical procedure has an 85% chance of success. A doctor performs the procedure on 8 patients. *Determine the probability* that 7 of the procedures will be successful.

Answer:_____ (Round your answer to three decimal places.)

9. The average time a person uses a Stairmaster™ is 20 minutes with a standard deviation of 5 minutes. If a person is selected at random, *determine the probability* that they will use the Stairmaster™ anywhere from 15 to 25 minutes.

Answer:_____ (Round your answer to three decimal places.)

10. Which scatterplot below demonstrates a *negative association* between the independent and the dependent variables?

A **B** **C**

Answer (circle): A B C

Appendix C

Post-script for Comparison of Student Performance and Attitude in a Lecture Class to Student Performance and Attitude in a Telecourse and a Web-based Class

Welcome to the end of Math 155, Introduction to Statistics. This class has been taught in three different ways, lecture, telecourse and web-based. A member of Lakeland's management team, Bill Ryan, is working on his doctorate program and as a student he is asking for your assistance. Your involvement is strictly voluntary and your participation does not impact or affect your grade in any way. There will be the final exam that will be taken now. There is also a written survey that asks twenty-six (26) multiple choice questions about your opinion regarding the method of delivery used. This should take approximately twenty (20) minutes of your time. There are also places to write in your ideas, comments and suggestions.

You will notice that the survey has a place for your name. Your names are needed to correlate these two data collection tools and the pre-test that was taken in the beginning of this term. During this time the data with your name on it will be collected and delivered to Bill Ryan for grading and for security. I will not see the grades and your name, individual grade and opinion will <u>not</u> be used in his dissertation. The data collected from all of these tools will be averaged together and grade, name or opinion will identify no one individual person. I will provide anyone with his office, phone number and email address if you want. He expects to finish and graduate in December 2000 and copies of his dissertation will be available in the Lakeland Community College Library.

This research project is looking at how different delivery systems impact the college and how each of you is impacted as well. Your identity and confidentiality will be maintained and your participation is strictly voluntary. Do you have any questions?

Bill wants to express his appreciation and grateful thanks to all participants. He understands the time and effort this takes in addition to normal coursework and from one student to another wants everyone to know how grateful he is.

Appendix D

Student Attitudinal Survey

PURPOSE OF THIS QUESTIONNAIRE: The purpose of this questionnaire is to obtain your feedback about taking a class at Lakeland Community College. Students are one of the best sources of information in helping us recognize issues and develop short and long-term strategies to address these issues. Thank you very much!

DIRECTION: Please read each question. Fill in the appropriate space on this form. All information on this evaluation is completely confidential and names will not be divulged. From one student to another I thank you for participating in this voluntary study!

Distance Learning Student Survey

Spring 2000

Course ID/Title: _____

Full Name: _____

Date: _____

Section 1. Demographic Information

1.1 1. Why did you decide to take this course?

____ To fulfill a general education requirement
____ To fulfill a requirement for my major
____ The subject matter looked interesting
____ The instructor has a good reputation
____ It was offered at a convenient time
____ It was offered at a convenient location
____ It was offered via the Internet / TV

1.2 What is the highest degree you plan to earn from any college or university?

____Certificate Associate of Arts
____Associate of Applied
____Science Bachelor of Arts or Science
____Master of Arts or Science Graduate or Doctorate Degree
____ I don't expect to earn a degree
____Other

1.3 Which of the following best describes your reason for taking college courses at this time?

____To advance in current position
____To discover new job opportunities
____Personal enrichment
____To earn a college degree
____Other, please specify:
_____

1.4 Please specify how many credit hours are you currently taking? _____

1.5 On average, how many hours per week do you spend on campus for classes or working in labs on coursework?

__ 0--3 hours __4--6 hours __7--9 hours __10--12 hours __13--15 hours __16 -- 18 hours __19 or more hours

1.6 How many hours per week do you work for pay?
__ 0 __1-15 hrs/wk __ 16-20 hrs/wk __ 21-25 hrs/wk __ 26-30 hrs/wk __ 31-40 hrs/wk
__41 or more hrs/wk

1.7 Do you have a learning disability or are you physically challenged/differently abled?
____No
____Yes, (please explain)

_____

1.8 How far do you live from our institution or campus? (select the most appropriate response)
____0-5 miles ____6-10 miles ____11-20 miles ____21-50 miles ____51-100 miles
____100 miles or more

Section 2. Technological Sophistication

Please rate your ability to do each of the following by checking the appropriate number, from 1 = no knowledge/ability to 7 = expert user.

2.1 I use a spreadsheet/database program on a computer.

1 2 3 4 5 6 7
No Knowledge /ability Expert user

2.2 I can send and receive e-mail.

1 2 3 4 5 6 7
No Knowledge /ability Expert user

2.3 I can search for information on the Internet/World Wide Web.

1 2 3 4 5 6 7
No Knowledge /ability Expert user

2.4 I can electronically send and receive files by way of the computer (over a modem, the Internet/WWW etc.).

1 2 3 4 5 6 7
No Knowledge /ability Expert user

Section 3. Course Evaluation

Curriculum and Instruction: Please mark how you feel about the following statements after completing your distance course. Rank the statements from 1 (Strongly Disagree) to 7 (Strongly Agree)

3.1 The mode of delivery did NOT cause frustration or difficulty in completing the course successfully.

1 2 3 4 5 6 7
Strongly Disagree Strongly Agree

3.2 The delivery system or technology was reliable & stable.

1 2 3 4 5 6 7
Strongly Disagree Strongly Agree

3.3 My course of study provided clear learning objectives and expected outcomes for the course.

1 2 3 4 5 6 7
Strongly Disagree Strongly Agree

3.4 My course of study resulted in learning outcomes appropriate to the rigor and breadth of any traditional on-site comparable course.

1 2 3 4 5 6 7
Strongly Disagree Strongly Agree

3.5 The presentation and organization of the course assignments and material was coherent and complete.

1 2 3 4 5 6 7
Strongly Disagree Strongly Agree

3.6 The instructor provided encouragement, support, and feedback appropriate to meet my learning needs.

1 2 3 4 5 6 7
Strongly Disagree Strongly Agree

3.7 My course of study provided interaction between faculty and students and among students to meet my needs.

1 2 3 4 5 6 7
Strongly Disagree Strongly Agree

Section 4. Resources for Learning

4.1 The course ensured that appropriate learning resources are available to students. For example, links to related supporting web sites, access to videos and traditional library resources.

1 2 3 4 5 6 7
Strongly Disagree Strongly Agree

4.2 I had reasonable and adequate access to the range of student services appropriate to support my learning needs and style.

1 2 3 4 5 6 7
Strongly Disagree Strongly Agree

4.3 I was provided enough information (through advising or orientation) to determine I had the background, knowledge, and technical skills needed to be successful in the course.

1 2 3 4 5 6 7
Strongly Disagree Strongly Agree

4.4 I would NOT benefit from a pre-enrollment orientation seminar or workshop to prepare me to use the technology in order to be comfortable and effective.

1 2 3 4 5 6 7
Strongly Disagree Strongly Agree

4.5 The advising, recruiting, and admissions materials clearly and accurately represent the course and the services available.

1 2 3 4 5 6 7
Strongly Disagree Strongly Agree

4.6 I would recommend or consider taking another course using the same delivery vehicle.

1 2 3 4 5 6 7
Strongly Disagree Strongly Agree

Section 5.
Are there any additional comments or suggestions that you would like to make? Your suggestions are important to us. For example, are there ways to improve our existing courses, or new courses you would like to see developed? Your time and assistance is very appreciated!

Appendix E

Overall Attitudinal Survey Results

Pre-course Score

Score	# Respondents	Percent
0	2	4%
1	8	10%
2	14	18%
3	14	18%
4	24	31%
5	10	13%
6	3	3%
7	2	2%
8	1	1%
9	0	0%
10	0	0%
TOTAL	**78**	**100%**

Overall Final Course Grade: All Delivery Methods Combined

Final Grade	# Respondents	Percent
A=4	13	17%
B=3	20	26%
C=2	25	32%
D=1	15	19%
F=0	5	6%
TOTAL	**78**	**100%**

1.1. Why did you decide to take this course?

(NOTE: Totals may not equal n=57 or 100% because some respondents answered more than one answer or chose to not answer)

1.1a. To fulfill a general education requirement

30 of 57 surveyed = 53%

1.1b. To fulfill a requirement for my major

21 of 57 surveyed = 37%

1.1c. The subject matter looked interesting

8 of 57 surveyed = 14%

1.1d. The instructor has a good reputation

4 of 57 surveyed = 7%

1.1e. It was offered at a convenient time

4 of 57 surveyed = 7%

1.1f. It was offered at a convenient location

3 of 57 surveyed = 5%

1.1g. It was offered via the Internet/TV

17 of 57 surveyed = 30%

1.2. What is the highest degree you plan to earn from any college or university?

Certificate Associate of Arts
3 of 57 = 5%

Associate of Applied Science
none

Bachelor of Arts or Science
23 of 57 = 40%

Master of Arts or Science
27 of 57 = 48%

Graduate or Doctorate degree
none

I don't expect to earn a degree
4 of 57 = 7%

1.3 Which of the following best describes your reason for taking college courses at this time?

1.3a. To advance in current position

6 of 52 = 12%

1.3b. To discover new job opportunities

4 of 52 = 8%

1.3c. Personal enrichment

24 of 52 = 46%

1.3d. To earn a college degree

18 of 52 = 34%

1.3e. Other – specify

--to complete BSN

--to get out of high school

--to prepare for grad school

--pre-req for masters program

--to complete my MSN at CWRU

--PSEO program (Post-Secondary Education Option)

--to earn college degree

--get credits early

--teaching certification

--general knowledge and practical sense of stats

1.4 Please specify how many credit hours you are taking

637 hours total taken by 56 students = 11.375 hours per student

1.5 On average, how many hours per week do you spend on campus for classes or working in labs on coursework?

1.5a 1= 0-3 hours
12 of 53 = 23%

1.5b 2= 4-6 hours
10 of 53 = 19%

1.5c 3= 7-9 hours
9 of 53 = 17%

1.5d 4= 10-12 hours
10 of 53 = 19%

1.5e 5= 13-15 hours
2 of 53 = 4%

1.5f 6= 16-18 hours
6 of 53 = 10%

1.5g 7= 19 or more hours
4 of 53 = 8%

Hours Spent on Campus	# Respondents	Percent
0-3	12	23
4-6	10	19
7-9	9	17
10-12	10	19
13-15	2	4
16-18	6	10
19+	4	8
TOTAL	**53**	**100%**

1.6. How many hours per week do you work for pay?

1.6a 1= 0
none

1.6b 2= 1-15 hrs/wk
7 of 55 = 13%

1.6c 3= 16-20 hrs/wk
9 of 55 = 16%

1.6d 4= 21-25 hrs/wk
7 of 55 = 13%

1.6e 5= 26-30 hrs/wk
5 of 55 = 9%

1.6f 6= 31-40 hrs/wk
17 of 55 = 31%

1.6g 7= 41 or more hrs/wk
10 of 55 = 18%

Hours Work for Pay	# Respondents	Percent
0	0	0
1-15	7	13
16-20	9	16
21-25	7	13
26-30	5	9
31-40	17	31
41+	10	18
TOTAL	**55**	**100%**

1.7 **Do you have a learning disability or are you physically challenged/differently abled?**

55 of 57 = 96% are not disabled
2 of 57 = 4% are disabled

1.8 How far do you live from our institution or campus? (select the most appropriate response)

1.8a 1= 0-5 miles
15 of 56 = 27%

1.8b 2= 6-10 miles
16 of 56 = 28%

1.8c 3= 11-20 miles
15 of 56 = 27%

1.8d 4= 21-50 miles
10 of 56 = 18%

1.8e 5= 51-100 miles
none

1.8f 6= 100 miles or more
none

Miles from Campus	# Respondents	Percent
0-5	15	27
6-10	16	28
11-20	15	27
21-50	10	18
51-100	0	0
100+	0	0
TOTAL	**56**	**100%**

Section 2. Technological Sophistication
Please rate your ability to do each of the following by checking the appropriate number, from 1 = no knowledge/ability to 7 = expert user.

2.1 I use a spreadsheet/database program on a computer.

1 (none) – 7 (expert)	# Respondents	Percent
1	7	12
2	10	18
3	9	16
4	8	14
5	13	22
6	5	9
7	5	9
TOTAL	**57**	**100**

2.2 I can send and receive e-mail.

1 (none) – 7 (expert)	# Respondents	Percent
1	2	3.5
2	2	3.5
3	3	5
4	4	7
5	9	16
6	15	26
7	22	39
TOTAL	**57**	**100**

2.3 I can search for information on the Internet/World Wide Web.

1 (none) – 7 (expert)	# Respondents	Percent
1	0	0
2	0	0
3	5	8
4	9	16
5	9	16
6	18	32
7	16	28
TOTAL	**57**	**100**

2.4 I can electronically send and receive files by way of the computer (over a modem, the Internet/WWW etc.).

1 (none) – 7 (expert)	# Respondents	Percent
1	8	14
2	6	10
3	5	9
4	5	9
5	9	16
6	9	16
7	15	26
TOTAL	**57**	**100**

Section 3. Course Evaluation

Curriculum and Instruction: Please mark how you feel about the following statements after completing your distance course. Rank the statements from 1 (Strongly Disagree) to 7 (Strongly Agree)

3.1 The mode of delivery did NOT cause frustration or difficulty in completing the course successfully.

1 (disagree) – 7 (agree)	# Respondents	Percent
1	3	6
2	8	14
3	3	6
4	8	14
5	14	25
6	8	14
7	12	21
TOTAL	**56**	**100**

3.2 The delivery system or technology was reliable & stable.

1 (disagree) – 7 (agree)	# Respondents	Percent
1	0	0
2	4	7
3	4	7
4	9	16
5	16	29
6	15	27
7	7	14
TOTAL	**55**	**100**

3.3 My course of study provided clear learning objectives and expected outcomes for the course.

1 (disagree) – 7 (agree)	# Respondents	Percent
1	1	2
2	1	2
3	3	5
4	9	16
5	11	20
6	17	31
7	13	24
TOTAL	**55**	**100**

3.4 My course of study resulted in learning outcomes appropriate to the rigor and breadth of any traditional on-site comparable course.

1 (disagree) – 7 (agree)	# Respondents	Percent
1	3	5
2	2	4
3	7	13
4	8	15
5	14	25
6	9	16
7	12	22
TOTAL	**55**	**100**

3.5 The presentation and organization of the course assignments and material was coherent and complete.

1 (disagree) – 7 (agree)	# Respondents	Percent
1	1	2
2	2	4
3	2	4
4	6	11
5	14	25
6	14	25
7	16	29
TOTAL	**55**	**100**

3.6 The instructor provided encouragement, support, and feedback appropriate to meet my learning needs.

1 (disagree) – 7 (agree)	# Respondents	Percent
1	0	0
2	3	6
3	1	2
4	10	19
5	12	22
6	11	20
7	17	31
TOTAL	**54**	**100**

3.7 My course of study provided interaction between faculty and students and among students to meet my needs.

1 (disagree) – 7 (agree)	# Respondents	Percent
1	1	2
2	6	11
3	6	11
4	15	29
5	9	17
6	8	15
7	8	15
TOTAL	**53**	**100**

Section 4. Resources for Learning

4.1 The course ensured that appropriate learning resources are available to students. For example, links to related supporting web sites, access to videos and traditional library resources.

1 (disagree) – 7 (agree)	# Respondents	Percent
1	0	0
2	3	5
3	3	5
4	11	20
5	10	18
6	16	30
7	12	22
TOTAL	**55**	**100**

4.2 I had reasonable and adequate access to the range of student services appropriate to support my learning needs and style.

1 (disagree) – 7 (agree)	# Respondents	Percent
1	1	2
2	3	6
3	1	2
4	9	17
5	14	25
6	17	31
7	9	17
TOTAL	**54**	**100**

4.3 I was provided enough information (through advising or orientation) to determine I had the background, knowledge, and technical skills needed to be successful in the course.

1 (disagree) – 7 (agree)	# Respondents	Percent
1	2	3
2	2	3
3	5	9
4	10	18
5	15	26
6	13	23
7	10	18
TOTAL	**57**	**100**

4.4 I would NOT benefit from a pre-enrollment orientation seminar or workshop to prepare me to use the technology in order to be comfortable and effective.

1 (disagree) – 7 (agree)	# Respondents	Percent
1	5	9
2	7	13
3	4	7
4	13	24
5	6	11
6	10	18
7	10	18
TOTAL	**55**	**100**

4.5 The advising, recruiting, and admissions materials clearly and accurately represent the course and the services available.

1 (disagree) – 7 (agree)	# Respondents	Percent
1	0	0
2	5	9
3	3	6
4	12	22
5	15	28
6	12	22
7	7	13
TOTAL	**54**	**100**

4.6 I would recommend or consider taking another course using the same delivery vehicle.

1 (disagree) – 7 (agree)	# Respondents	Percent
1	3	5
2	4	7
3	4	7
4	6	11
5	8	15
6	12	22
7	18	33
TOTAL	**55**	**100**

Section 5.
Are there any additional comments or suggestions that you would like to make? Your suggestions are important to us. For example, are there ways to improve our existing courses, or new courses you would like to see developed? Your time and assistance is very appreciated!

Spring 00
Traditional classroom
I didn't have anything creative to say here

Telecourse
I took this class in this format to see how I would do in an independent learning situation. It turned out to be more work than I thought, but that's what I wanted to know. Looking back, I think there are benefits to both types of instruction. But in either case, you only get back as much as you put in.

Online
The computer software selected for this class was extremely effective to learning the material.

I don't think taking tests in the learning center is a good idea. If the workload is increased, students will learn the material even if they have the answers in front of them (repetition equals learning). It is a pain to get up to the tutorial to take tests, especially since I am a full-time student at another university.

Instructors [should] have office hours that would also benefit evening students.

I've taken 3 video classes and they didn't compare to this one. This class is better organized, materials used to teach are a lot better. I liked the course. Received quick and accurate response from instructor.

My reason for taking online is I have a hard time coming to campus. I wish the tests had also been online – you could time them or something. Although the teacher was very nice, he never answered my e-mail.

Winter 00

Online
The worst decision of a course I ever chose to take. A straight "A" (with an occasional "B") student getting a "C" or lower in a course should tell you something is wrong.

Need to assign homework from sections of book to make sure people are reading and that they know the info.

Telecourse
I don't think I will take a telecourse again though this did work with my schedule. I beat myself up with the material as my brain doesn't work well with math. Time requirement was huge for a simple (?) math course. Hard to keep up.

This course is not recommended for telecourse.... I would like to document a lot of other information and would like to set up a time with the dean of match [sic] to discuss the problems with this class as a telecourse since I have not gotten adequate response on a teacher student level (listed home phone number). Here are the reasons:

1. When I viewed the shows, they offered no real help in learning what was expected to know on the test.
2. True, there is a lot of information in different websites for this course, but it becomes more of a "search mission" instead of a convience [sic]. Persons who lack a large amount of personal time fine it hard to go thru all of the websites areas and suggestions to find REAL information that is needed.
3. The recommended homework had 2 faults:
    1. [sic] It did not coincide with what was on the test and, therefore, the practice done on homework examples were for naught when test time came.
    2. [sic] When I got stuck on homework, where could I go to ask for help? How long would it take to get a response? Do I: A) talk to a phone machine or B) e-mail to the professor daily?
4. I had no idea I would need a special calculator. I came to both Midterms I + II only to find that when I plugged in the numbers for the equations, my test grades were compromised ...since my calc only went so high (?!). A lot of the test equations were a lot more complicated than what was in the book. It was almost like a game to see how "smart" you can be without the proper pretesting practice for an extensive group of questions and math calculations.
5. I had been very concerned and expressed my concern at the beginning of the quarter to Prof. Davis regarding my not being able to attend afternoon test reviews because of my work schedule. I was very fastidious in trying to bring blank tapes and request that the review would be taped for help for me to study. He was very upset when I didn't immediately pick up the tapes from his mailbox. I was left with nasty e-mail messages – I feel that I was making him disadvantaged by helping me.

Fall 00

Online

I appreciate the convenience of taking a telecommunications course. The one thing I didn't have the ability to use is the Activstats data disk. I found it to be slow in delivery of information and the statistical program unfriendly to use. They should get a new program.

I took the Internet section of MTH155. I much preferred other telecourse formats I had taken to this one. More prof contact would improve it.

Good: Mr. Davis was available by phone or appt. at your convenice [sic] at anytime – all the time. Bad: The book did not really explain much of the formulas clearly to understand. Maybe at each chapter, Mr. Davis can post example problems of the important formulas – from the material being studied.

The class was very informative. The online work was great.

Good: Computer simulations, flexibility of test schedules, not having to come to class were good points. Bad: lack of contact w/instructor or other students, no lectures~I find them helpful, and announcements made only on the website, not sent by e-mail~meant I missed the warning on some assignments or study sessions until quite late. All announcement need to be posted to e-mail list as well as website. Never met the instructor.

Good: Convenient, flexible. Bad: requires a lot of discipline; the testing center too distracting with students constantly coming in and out and having the facilitator talking to every student or on phone tracking down professors was bothersome (I do understand she needs to explain things – maybe take care of that outside the door…?)

Good: Text book examples – you could follow what was going on. Bad: The audio stats software was slow to react. Need to put additional test in.

Good: Going at own pace. Bad: No one who can give an answer or discuss a problem until a later date. Need more incentive for interaction with other students.

Telecourse

The videos would have been better if they actually showed and worked out a couple of problems with the viewers. I could not attend the review sessions for this course. Therefore, I had to rely mainly on the book examples which proved difficult.

The only suggestion I have is to have one class in between tests which would allow questions and more structure to the class.

Good: convenience. Bad: Did not like the videos. Could have shown more on how to do the problems. It is hard when the review sessions conflict with other classes.

Bad: No classes, hence, I forgot to keep up with my homework (but that's my fault).

Good: You can do each program whenever you had time. The review sessions were very good. Bad: Not enough instruction from videos/book. Should possibly have a review after every few programs instead of right before the tests.

Good: Layout of the book, presentation of videos, ease of contacting the instructor. It's a difficult course – these made it easier. This one blew me out of the water – good course, though.

Traditional classroom

The instructor was fantastic. Admission materials should indicate that this is an introductory course. Also, there weren't many teaching assistance available in math resource center.

Overall, it was kind of exciting at first to use the Activestats in math; it got boring towards the end. I rather prefer being taught by a human being and use technical devices only if a teacher is not available.

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